THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Electrical Benevolence	329
The Home Office Regulations Explained	330
A Use for Obsolete Electricity Meters (*illus.*)	331
Diesel Engines for Small Stations	331
The Development of Inventions	332
Correspondence:—	
Contractor or Manufacturer?	333
Cooking Apparatus	333
Protection and the Electrical Industry	333
The Manufacture of Cement	335
Cinematographs	336
The Japan-British Exhibition	336
Legal	337
Post Office Engineering Department, London	340
Business Notes	340
Notes	347
Electrical Driving Installation at the Bannerman Mills Co.'s Brunswick Mill, Manchester (*illus.*)	349
City Notes	354
Market Quotations	360
Stocks and Shares	360
Share List of Electrical Companies	361
Metal Market.—Fluctuations in February	363
Signalling in Mines (*illus.*)	363
Our Legal Query Column	365
Electrical Trades Benevolent Institution Dinner	365
Proceedings of Institutions:—	
Modern Electric Time Service (*illus.*)	365
Some Notes on Overhead Line Construction (*illus.*)	368
New Electrical Devices, Fittings and Plant (*illus.*)	370
Foreign and Colonial Tariffs on Electrical Goods	372
New Patents Applied For, 1910	372
Contractors' Column	Advertisement pages 58 and 60

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(J. A. BERLY'S).

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ELECTRICAL BENEVOLENCE.

ELSEWHERE we publish a report of the proceedings at the Festival Dinner of the Electrical Trades Benevolent Institution last week, a function the keynote of which was goodwill towards men—electrical men. Of all the social gatherings of the year in connection with the electrical industries, there is not one which has a more admirable or worthy object than this one, which indeed, we believe, stands alone in its altruistic purpose; though we could wish, as one of the guests remarked to us, that less were expended upon the inner man and the balance thus saved allotted to the needy one, we doubt whether such a departure from the traditional course would prove to the advantage of the latter in the long run, and certainly the solid return in the shape of contributions to the fund was very acceptable.

But it is not only the big cheques, the bank notes, and the guineas that are called for; the half-crowns and shillings are every bit as welcome, and in their collective strength are even more powerful than the former. It is the private soldiers that make an army; and it is their courage that wins the battle. So, too, it is the small contributions that fill the coffers, and the cheerful self-denial of their donors that ensures the permanence and stability of such a fund as that of which we speak. Let no one think his offering too small; if it is as much as he can afford, it is as great as that of any man, and as precious to the Institution. Goodwill in an industrial concern is often a nebulous and uncertain quantity, but in a charitable organisation it is the working capital, the assets, the motive force of the entire system. The liability of the shareholders is in proportion to their means, and though there are dividends, it is true, none of the shareholders wishes to become entitled to them!

Now, it is a very easy thing, say, in a warehouse employing a number of men, to post a notice regarding the nature of the Electrical Trades Benevolent Institution, its wide scope, the freedom with which relief is given, and the importance of supporting such an admirable and useful organisation; but that is not the best way to promote its success. Personal service is indispensable. Let those who wish to benefit their comrades go round amongst them, explaining the objects and needs of the Institution, and collecting whatever they can—not even a penny is to be despised. In large establishments a committee should be formed to carry out the work—this is far better than the isolated efforts of individuals, be they never so earnest and able. Above all, it is important to establish the system of collection at regular intervals—weekly, if possible; the oftener the better, as the amounts being smaller are less felt by the donors. By this means, as Mr. Hirst pointed out at the dinner, wonderful results can be accomplished.

Many men feel a deep-rooted repugnance to "begging," and refuse to take part in it. In this they not only are mistaken, but by implication cast a reflection upon the nature of those who, though no less lofty and independent in character, force themselves to undertake such work for the benefit of their suffering fellow-creatures. The task may be distasteful, but it is honourable. To give a subscription is easy, soothing to the conscience, and involving no personal effort; to extract one from a friend (while not forgetting to contribute one's own share) is a vastly different matter, a feat worthy of congratulation—and emulation.

While in the foregoing we have placed emphasis upon the importance of small subscriptions, let it not be imagined that we under-estimate the ability of others to lend real strength to this Fund. We do not desire to spread ourselves upon the now every-day view that to dispose of a fair proportion of one's wealth during the owner's lifetime is a far more laudable act than to will it away in big gifts

when one has no further personal use for it, but there is one phase of this Fund which should especially appeal to those who have it in their power to will a thousand or so to charitable objects for distribution by their executors. The electrical industry is young, though it is no longer an infant. It has passed through bad times without there being a very heavy demand for pecuniary assistance. But what of the future? The industry is bound to expand as time goes on, but some who were in "at the birth" of the industry, or have been in it for the last decade or two, and have made little personal profit, will not always be able to continue in the race, and they may fall out disabled by the way as the result of the stress of competition. For these and some others the Fund will be more a need of future years than it may be now. Here, it seems to us, we have an appeal directly to those who can afford to enable the Fund in the future to reach large proportions, enabling pensions and other allowances to be made to some who may need help over a period of years. When making a will, only a stroke or two of the pen may turn a bequest for a Cat's Home, or some other more laudable institution, in which the testator has no direct personal interest, into one of substantial value to the workers in the industry in which the money has been accumulated, by remembering the Electrical Trades Benevolent Institution.

We believe that when the annual balance sheet is circulated among subscribers and donors, as it will be shortly, in accordance with the rules of the Fund, it will be seen that the pressing claims so far met have not been large, but they will grow, and the necessity is for some large assistance in building up a big Fund to meet them without depleting the assets. Let us have, therefore, not only a present income of both small and large annual subscriptions and donations, but also additions in the form of bequests to benefit those who fall out under the pressure of years and of strain after we have left the industry for good.

THE HOME OFFICE REGULATIONS EXPLAINED.

From time to time letters appear in our "Correspondence" columns bearing on the application of one or other of the Home Office Regulations regarding the use of electricity. The complex nature of the conditions under which electricity is used are such that the precise bearing of some of the Regulations is even yet not fully realised. Numerous applications have been received at the Home Office for more detailed information as to the meaning and limitations of the Regulations, and the Secretary of State has instructed the Electrical Inspector of Factories to prepare a memorandum explaining their effect in the several classes of installations to which they apply. This memorandum has now been issued in pamphlet form containing about 50 pages of explanatory matter.*

It is pointed out in the preface that the Secretary of State has no power to give an authoritative interpretation of the Regulations—this being the function of the courts of law—and the memorandum is subject to revision as experience accumulates or fresh discoveries are made.

The definitions and Regulations are dealt with individually and seriatim, a more or less lengthy explanation following each, according to the scope or importance of the case in point. As touching the scope of the Regulations it is interesting to note that Sec. 79 of the Factory and Workshop Act, 1901, applies to factories, workshops, warehouses, docks, wharves and quays, to the processes of loading, unloading or coaling any ship in any dock, harbour, or canal, to buildings in process of construction, or structural work in connection with buildings with the use of power machinery, also private lines and sidings in connection with the above. The point which we would here emphasise is that the temporary work in connection with the electrical driving of the machinery used in building work comes under the rules equally with more permanent work. This is a fact that is apt to be overlooked. A somewhat curious point is that whilst an electrical generating station for supplying electricity by way of trade comes within the scope of the Regulations, a private generating station does not, unless a portion of the electricity generated is supplied to a neighbour or other person and charged for. If it is supplied gratuitously the Regulations do not apply. Hence a station run by technically-trained engineers is a dangerous place within the meaning of the Act, and is, therefore, the subject of special legislation, whereas an electrical generating station run by the groom, gardener or other handy man about the estate does not come within the law. This is, of course, not the fault of the Regulations.

Referring to the duties of occupiers and persons employed, a very broad interpretation is placed on these. Thus, in the explanatory note, the inspector says: "The responsibility for the observance of the Regulations is not confined to the occupier. All persons engaged in any way in electrical work to which the Regulations apply should make themselves acquainted with the Regulations, as any person employed who fails to comply with them is liable to be prosecuted and fined." This is a rather far-reaching statement, and we are not sure that we quite apprehend its limitations. It is obvious that the electrical contractor renders himself liable to prosecution for work carried out which fails to comply with the Regulations in every particular. Similarly the wiremen who actually put up the work are equally liable. And it must be remembered that the liability applies not only to the actual design and erection of the installation, but also to the design of the fittings, switches, distribution boxes and other accessories employed. Now, what we do not quite understand is the liability of the manufacturer and his employés for making and selling apparatus which does not conform with the Regulations. It will be found on reading the memorandum that a very considerable portion of it deals with the design of switchboards, distribution cabinets, switches, fuses, circuit-breakers, sockets, lampholders, portable hand-lamps and fittings, and other common adjuncts of installation work. It is not an uncommon thing to see apparatus advertised as "in accordance with Home Office requirements." Surely a contractor or an occupier is justified in assuming that a manufacturer has satisfied himself beyond all question that this is the case before advertising it. We do not know what the procedure may be, but we understand that the Home Office inspector never approves or otherwise any fitting. So far as we understand the duties they are to inspect installations and to point out anything which does not comply with the Regulations, but not to approve. The fact of an installation having been passed by the inspector is no guarantee that everything is in accordance with the requirements, and, in the event of accident, the occupier is just as liable as if no inspection had been made. If our interpretation of the requirements is the correct one, we are bound to say that some of the accessories we see advertised as "complying with Home Office requirements" certainly do not comply, and we think it is important to know if the manufacturer is as liable to prosecution under the Factory Act for selling an article which is not in conformity with the requirements as the contractor who uses it, and the workman who fixes it. If the manufacturer is liable, then his workmen are also liable. This we think follows from the wording of the Regulation under consideration, which reads as follows:—"And it shall be the duty of all agents, workmen, and persons employed to conduct their work in accordance with these Regulations." As pointed out above, the electrical inspector in his memorandum interprets this as "all persons engaged in any way in electrical work." Whilst it is true that the Regulations are concerned with the generation, distribution and use of electricity in factories, it is common sense, even if it be not common law, that the man who makes and sells a fitting or other appliance is equally responsible with him who installs it, more particularly when such fitting is sold as definitely complying with the requirements. We think it desirable to emphasise this aspect of the matter in view of the fact that our opinion as to the non-compliance of certain articles is strengthened on perusing the inspector's memorandum.

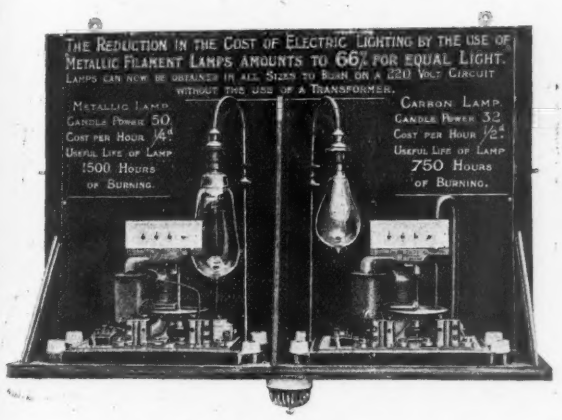
The memorandum is one which should be carefully studied by our readers, and we shall probably deal with it in greater detail in a future issue.

* Form 928. February, 1910. Factory and Workshop Acts, 1901 and 1907. Price 3d.; postage, 1d. Wyman & Son.

A USE FOR OBSOLETE ELECTRICITY METERS.

The majority of electricity suppliers are now at one in their recognition of the advisability of, and ultimate benefit to be realised by, making known the economy of electric lighting with metallic-filament lamps to all classes of consumers, actual and possible.

One of the difficulties of the supply engineer lies in the fact that the advantage of the modern lamp is realised most promptly by the proprietors of large business and public premises, the smaller user of artificial light being less susceptible to argument in favour of changes which, however economical ultimately, call for an immediate expenditure for their realisation, and those to whom in any case the expense of lighting is not a large item, are apt to credit the statements of the electricity department and the lamp makers with the usual standard of advertising accuracy, and leave the matter without investigation; it is, however, easy to afford simple evidence, and at the same time interest the public more effectually than can be done by means of


THE REDUCTION IN THE COST OF ELECTRIC LIGHTING BY THE USE OF METALLIC FILAMENT LAMPS AMOUNTS TO 66% FOR EQUAL LIGHT.
LAMPS CAN NOW BE OBTAINED IN ALL SIZES TO BURN ON A 220 VOLT CIRCUIT WITHOUT THE USE OF A TRANSFORMER.
METALLIC LAMP.
CANDLE POWER 50.
COST PER HOUR ¼d.
USEFUL LIFE OF LAMP 1500 HOURS OF BURNING.
CARBON LAMP.
CANDLE POWER 32.
COST PER HOUR ½d.
USEFUL LIFE OF LAMP 750 HOURS OF BURNING.

Tungsten v. Carbon.

printed matter. The illustration shows an arrangement of a device, by no means new, but which has not had the vogue amongst contractors which it deserves. Two rotating meters of similar size are coupled to a tungsten and a carbon lamp, the whole being fitted in a glazed case, and suitably backed by a simple statement of costs. Most engineers have a surplus of old type meters quite suitable for this purpose, and the whole arrangement can be fitted up at small cost. If care is taken to start the meters at zero and show a record of the hours run, the comparative light and cost can be seen at a glance, and the difference in the speeds of the meter disks never fails to appeal to the observer. The advertisement might be still further emphasised by placing in each compartment the value in cash of the consumptions shown on the dials; perhaps, however, the enterprising contractor may find it more convenient to confine himself to a written statement.—J. W.

Secondary Cells in Tropical Climates.—Writing to *Nature* on this subject, Mr. E. P. Harrison, of the Physical Laboratory, Presidency College, Calcutta, refers to the difficulty experienced in hot countries in keeping small accumulators in working order, and points out that this is probably due to the cells being filled with dilute acid of density 1·190 at a temperature of 30° or 35° C. While this is a proper density to use in a climate where the temperature is 15° to 20° C., corresponding to a 20 per cent. mixture, it is too high for a hot climate, where it really represents a 23 per cent. mixture; a density of 1·170 or even 1·150 is more suitable in hot climates.

Canada.—According to *Commercial Intelligence*, a scheme is on foot, backed by London capital, to provide electric lighting and tramways in Prince Rupert, B.C., also for the erection of a smelter and provision of a steamship service. The expenditure is estimated at 5 million dollars.

DIESEL ENGINES FOR SMALL STATIONS.

[COMMUNICATED.]

In spite of the very low price charged for electric power in many districts by the supply companies, there are but very few instances, where more than 200 H.P. is required, in which current cannot be generated more economically than it can be bought from outside sources; and when it is considered that in quite a large proportion of the cases the works, factories, &c., do not come within the area of supply, it is easy to see that small self-contained generating stations are not in any great danger of becoming obsolete owing to the cheapening of production on a large scale. It is notable also that, beyond a certain limit, the increase in size and output of a central station does not always bring a proportionate, or in some instances even an actual, reduction in running costs, and there is very little likelihood of any great diminution in the selling price of electricity in the near future.

Up to within the last few years nearly all the smaller stations contained steam-driven dynamos, and the use of oil or gas engines for the purpose had not seriously been considered; but the introduction of Diesel oil engines and suction-gas engines very rapidly changed the outlook, and even at the present time, when the price of the Diesel engine is so high, the cost of running small stations equipped with these engines is remarkably low, and will become lower still after the Diesel patents completely run out, and the engines become cheaper. It may be said that the first cost has not much bearing on the running cost, but in effect it does make a considerable difference, since the depreciation charge and the yearly interest on capital outlay usually amount to one-half of the total cost of generation. It is evident, therefore, that the high price of Diesel engines has tended to increase the cost of electricity for small plants considerably beyond that warranted by the very high efficiency of these engines.

Diesel engines possess many inherent and advantageous qualities which render them more applicable for small generating stations than steam engines. The principle upon which they work is generally known, but may be briefly described. Compressed air, stored in cast-iron vessels about 6 ft. high and 12 in. diameter, is admitted to the cylinder to start the engine, which rapidly reaches full speed. Air is drawn into the cylinder from the atmosphere in the suction stroke of the engine, and in the return stroke this is compressed to a very high pressure, the air therefore attaining an extremely high temperature—usually about 1,100° F. In the working stroke the fuel is injected gradually into the cylinder, combustion taking place owing to the heat of the air, and at a certain predetermined point the supply is cut off, and further work is done by expansion. In the fourth stroke the burnt gases are exhausted through the silencer in the ordinary way. The chief gain in efficiency over the other oil motors on the market is due to the fact that compression takes place before the fuel is mixed with the air, and a larger proportion of the heat of compression is converted into useful work.

The efficiency of the Diesel engine varies but slightly with the load, and this has a marked effect on a station with a low load-factor; and as to actual fuel costs, there can be no doubt regarding the enormous saving effected. The cost of attendance is probably less than with any other prime mover, since no stokers are needed as with steam engine plants, and of course boilers and their accessories are dispensed with. Cooling water is, however, necessary, and if a plentiful supply is not available, a cooling tower of the ordinary type with a fan and pump must be provided. A fuel tank, fuel filters and an oil pump are also essential, but these are very small items.

In considering the economy to be effected with the employment of Diesel engines, a generating station of, say, 180 KW. may be taken as an example, and the relative costs of a steam and Diesel equipment compared. As a fair average it may be estimated that a station of this size would cost about £30 per KW. for the entire plant and buildings—probably more with a steam installation and less with Diesel engines—but for the moment we may take the capital outlay to be the same in both cases, the total being for the station in question £5,400. Allowing the usual

10 per cent. for depreciation and interest on capital, we are debited at once with a sum of £540 per annum, showing how vitally this charge affects the cost of production. If we take a load factor of 20 per cent. over the whole year, the number of units generated would be approximately 315,000 KW.-hours, or 525,000 B.H.P.-hours, allowing an efficiency of 80 per cent. A Diesel engine consumes about 0·4 lb. of oil per B.H.P.-hour for almost all conditions of load, so that the total amount used per annum would be 210,000 lb., or about 94 tons, which, at the present market price of crude oil, would cost £212. Allowing a sum of £250 per annum for wages, stores, &c., the total cost of production for a year works out at £1,002, or 0·75d. per unit of electricity generated.

Considering now a steam station, the same amount may be allowed for interest and depreciation and also for wages and stores; while the steam consumption of the small engines of, say, 80 KW. each, which would have to be installed, would be at least 35 lb. per KW.-hour. The boilers would evaporate about 5 lb. of steam per lb. of coal—that is to say, the coal used would be 7 lb. per unit of electricity generated, or, with a 20 per cent. load-factor as before, the coal burned per annum would be 985 tons. Taking 12s. per ton as a reasonable price for coal delivered in the boiler house, the coal bill for the year would be £590, giving a total annual working cost of £1,380, or 1·05d. per unit generated, showing a balance of £378, or 0·3d. per unit, in favour of the Diesel equipment. It will be admitted that the figures above are not biased on the side of the latter, since, in the first place, the capital cost would in most instances show considerably to the disadvantage of the steam installation, when one considers the boilers, pumps and condensing plant which are necessary; any reduction in the original outlay re-acts very substantially on the working costs, and it will easily be seen that the forthcoming cheapening of Diesel engines will lead to their further adoption in all quarters. In the figures given above, if the interest and depreciation were not included, the saving effected would appear to be much greater, and though this is hardly a fair method of comparison, it is one that is frequently adopted. Moreover, though the same amount has been written off in both cases for attendance, this distinctly favours the steam plant, since here there must be at least two men regularly on the spot—the engine driver and the stoker—whereas with Diesel engines one is quite enough.

The mere saving in running costs is not the only thing to be considered in small generating stations, and the ease and speed with which Diesel engines may be run up and put on full load (in two or three minutes) is a distinct point in their favour, especially in mills, works, &c., where power may be unexpectedly required at all times, and so little of it that the cost incurred in having two men in to start up a steam engine to drive, say, a 10-H.P. motor for a couple of hours, is out of all proportion to the value of the work done. The Diesel engine, on the other hand, would be started up quickly, and the small amount of power would be generated at only a slightly higher cost (relatively) than if used for the whole factory.

Another most important point is that of reliability of working, since a day's shut-down, or even partial disablement at a busy time is disastrous, and in the average small station there is practically no surplus of power. The Diesel engine, properly treated, is as reliable, if not more so, than the steam engine, and has fewer auxiliaries, since with the latter there is always the possibility of failure of boilers, condensers, pumps, &c., to be considered. Provided the valves of the Diesel engine are cleaned once a week—an operation which takes a very short time—it may reasonably be expected to run for years with practically no attention, other than the yearly overhaul.

The Diesel engine is not, of course, the cure for all ills; for large powers it cannot oust the steam turbine at the present, though when the new two-stroke engine is developed there may be possibilities in this direction. Moreover, in many cases steam is necessary for other purposes, as for heating, and in breweries, where it can hardly be expected that oil engines would be installed; but there are many instances where they should most decidedly be used, and the very rapid progress they are now making, particularly on the Continent, is ample proof that their possibilities are now being realised. A more significant sign, perhaps, is the number of firms who are now making Diesel engines under licence; and it is satisfactory to notice that many of the best engine-builders in England are taking up their manufacture, for it is undeniable that the utmost care has to be exercised in the design and construction of this somewhat delicate engine.

THE DEVELOPMENT OF INVENTIONS.

By W. O. HORSNAILL, A.M.I.M.E., A.M.I.E.E.

THERE is a popular saying to the effect that any fool can think of a new device, but a clever man is required to make it in practical form and a genius to sell it.

There is something more than a basis of truth in this saying, and the patent records establish the fact that many good ideas have been protected without further development, whilst the difficulty of selling even an invention which has proved its utility, must have come home to the majority of patentees.

Unfortunately new ideas, and very often good ones, seem to occur more frequently to unpractical men as opposed to those having mechanical experience, with the result that the invention only reaches the protection stage instead of being carefully developed. It would seem that scope should exist for trained men to take in hand the ideas of others, and to put them into practical form.

The training required for those destined to undertake this work must be of the widest possible description, and not only should the aspirant be familiar with modern practice in all kinds of mechanical directions, but he should be a skilled worker in both wood and metal. In developing a mechanical invention a great deal of experimenting usually has to be done, and the appliances dealt with may often include several different kinds of material.

No doubt a number of ordinary workmen each skilled in one craft could be employed upon such work under the control of an experienced designer, but the risk of disclosure would be very much increased, and the work could not be so quickly carried out.

Such men are incapable of grasping an idea quickly, hence the designer would have to spend much time in explanation and the making of sketches before the parts required could be made.

On the other hand, a man skilled in almost any craft and possessing a wide experience of the devices adopted in many different kinds of machinery, would often be able to do the work in the time taken to explain the idea to an ordinary workman.

It must be admitted that men having these qualifications are difficult to obtain, and as time goes on the scarcity of those having an all-round training is likely to increase, owing to the spread of specialism; at the same time, we think that some of the younger generation who have an aptitude for invention might well consider the development of patents as a vocation for which they must fit themselves by an all-round training. The pay would be high for such services, and a demand for them is already apparent, this demand being certain to increase as the idea catches on and the existence of experts in this line becomes known.

The expenses of conducting such a business would be low, only a workshop being necessary with an equipment of small tools.

The larger parts could be ordered from other firms, a knowledge of machine drawing being included amongst the accomplishments of our expert to enable him to have these portions constructed elsewhere.

It need hardly be stated that work of this nature is confidential, and that those undertaking it would have to furnish first-class credentials, or in other ways convince inventors of their *bona fides* and integrity.

New outlets are constantly wanted by those who wish to be independent, and we can recommend such to consider the opening we have suggested.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Contractor or Manufacturer?

With regard to the controversy *re* the vagaries of the so-called contractor, I think much might be done to eliminate the "undesirable species" by a proper inspection of work and materials during progress. No work ought to be commenced until notice had been given to the supply authority, but often they know nothing about any intended installation until the work is nearly completed and all defects are hidden. Surely the lighting of a building is not so unimportant, especially in view of the fire risks due to bad work. I can fully endorse all that has been previously written about shoddy work. I could fill pages of examples, such as tube installations without any tees, bends, or other fittings, wires run without tube or casing, except where seen, common workshop flexible run in disused gas pipes, &c.

Perhaps the Municipal Electrical Association and the Contractors' Association might do something to remedy this state of affairs.

F. Spearing.

Wimbledon, *February 23rd*, 1910.

The contents of the letter in your issue of February 18th under the above heading will not, I hope, be allowed to pass without further criticism, in spite of the fact that in the opinion of the writer of the letter "no advantage can be gained by such correspondence."

Mr. Cramb, perhaps, will make it clear in what manner, "say, 12 men in one area attempt to control, for their own personal interest, a large business like the electric supply." Surely he cannot be serious in suggesting that contractors either wish or try to take upon their shoulders the control of the electric supply business.

Doubtless, in isolated cases the contractor may, in a thoughtless moment, drop a hint or make some suggestion or complaint to a member of the Electricity Committee, who in turn brings the matter to the front, as is the wont of these gentlemen; but this sort of thing does not in any way warrant municipal or direct trading.

Unfortunately, in any business there exists a considerable amount of strife between competitors to obtain the inadequate amount of work that is available, but if strife alone is used as an excuse for municipalisation, then all had better become Socialists at once.

Regarding publicity departments of supply companies, frequently they are a thorn in the flesh; analyse a number of them, and in many instances it will be found (as your correspondent, "One of the Much-maligned Contractors," suggested in a letter published in an issue of the Electrical Review a few weeks back) that they are composed of men, and frequently almost boys, who are neither engineers nor experts in installation work.

How much business that is frequently credited to them is actually brought into being by their efforts? It is an easy matter to call upon a new tenant of a house, shop or business premises, after they have already been well canvassed by contractors, and to obtain from them, or through the contractors, an application for a supply which the supply authorities would have obtained in any case.

Commissions are frequently paid to publicity men by the undertaking upon the basis of signed application forms received through them, and as it costs a contractor nothing to pass this form through these gentlemen's hands, they frequently do so, with the hope that they may obtain something in return in the form of names and addresses of callers at the municipal showrooms—and recommendations. Again, a practice so distinctly unfair to contractors is where municipal employés introduce manufacturers direct to consumers for the sale of various appliances, hire-purchase of motors, &c., the discount off which should have gone to a contractor, but part of which is allowed to the consumer and the other part too frequently goes to ensure further introductions from the same source; it is no use to blind ourselves to facts, these conditions do exist, and if not in the undertaking in which Mr. Cramb is interested, they do in others.

To sum up, would it not be as well for municipal engineers to seriously look into the matter, and see if publicity departments actually *pay*, after taking into consideration the annual and total costs? The fact that Mr. Cramb mentioned, viz., "that there is not sufficient work to go round," ensures that contractors will themselves carry out a vigorous canvassing campaign, without any cost to the ratepayers; many of the competent contractors, who specialise in installation work, are giving entire satisfaction to their clients, and it is neither necessary nor advisable that they should be harassed by the opinions expressed to prospective customers by publicity assistants of little or no experience; one would think that station engineers have sufficient to do to ensure a good and economical supply, without trying to run another business, in which they have not had the same experience as specialists, and which, at the present time, requires the undivided attention of many who are giving the whole of their time to the matter.

In conclusion, I would mention that I am not a Croydon contractor, but one who is fully acquainted with the matter under discussion.

Fair Play.

London, S.W., *February 23rd*, 1910.

Cooking Apparatus.

The Town Hall Committee of the Chester Corporation have under consideration the fitting-up of new cooking apparatus in the kitchen adjoining the banqueting chamber. If you know of any large buildings using electrical cooking apparatus on a large scale, I should be very glad indeed to know of them.

S. E. Britton,
City Electrical Engineer.

Chester, *February 22nd*, 1910.

Protection and the Electrical Industry.

Accustomed as we are to Tariff Reformers' strange arithmetic, one is still surprised at "Ex-communicated."

When he asserted that he exported his goods to all foreign countries, and paid the duties or made an equivalent reduction in price, I asked how this could be done; the average import tax on manufactures entering Germany being 25 per cent., entering America, 73 per cent., entering Russia, 131 per cent. He replied by saying that his particular goods involved a tax of about 4 per cent. in Germany, about 8 per cent. in Russia and about 10 per cent. in France.

I took as a fair instance an electric motor, which he admits is taxed 45 per cent. on value in America. I gave its actual weight and price, which worked out £45 per ton, and showed that the import taxes were:—

In Germany,	£2½	per ton, say	5	per cent. on value here.
In Russia,	£55	„	122	„ „
In France,	£12	„	27	„ „

He admits the German and French taxes per ton, but figures on a higher speed motor weighing 2½ tons, and actually assumes it costs as much as the low-speed motor I instanced, which weighed 3½ tons.

He gives the Russian import tax as 13s. 10d. per cwt., while it really is four times as much—viz., 55s. per cwt., as I stated, as anyone can verify by consulting Sec. 3 of par. 167 of the Russian tariff.

He says his profits are not abnormal, so he stands convicted of error in stating that he pays the duties in all foreign countries. On his own showing, the lowest of these tariffs, viz., the German, would reduce his net profit by no less than 5 per cent., and the American by 45 per cent.!

The markets of the whole world are open to us on as favourable terms as any other country obtains; so it would be highly foolish to quote higher prices in a free market than the f.o.b. quotations for shipment to protected markets; and in practice the same f.o.b. price is made for all markets, all charges, including import duties, being paid by the importer.

Replying to Mr. Rendell, my baker, butcher and tailor always have excluded my manufactures, as they have no use for them; I repeat, is this any reason why I should pay taxes on everything I buy from them?

If it does not suit Germans to import many electrical goods from England, as the price plus the duty payable in Germany makes them too dear, is this any reason why Englishmen should refuse to buy German goods that are better value than competing goods in this free market?

I am sure it was to the interest of Canada to remove the surtax on goods imported from Germany; I go much further, and say it would be much to the interest of Canada to buy English and all other goods in a free market. Even Tariff Reformers usually profess to desire free markets in other countries than their own.

C. E.

Your correspondent "Troglodyte" has discovered that some manufactured goods do get into Protected countries, and he thereby rather lets down those of your correspondents who have been pointing to "healthy competition" as an exclusive advantage of Free Trade.

Of course, all Protected countries import special designs and articles that can be made better elsewhere, but these are not allowed (as with us) to disturb the home market.

We are importing about £150,000,000 worth of manufactured goods, a large part of which are sold in direct competition with our own products. This figure, however, is no gauge of the price-cutting caused by unsuccessful foreign tenders in the home market, or of the loss to Germany of much of our export trade—as mentioned in my previous letter. If our large electrical manufacturing concerns, for example, had got the share of export trade they expected 10 years ago, they would not now be cutting everybody's throats at home in order to utilise their tied capital.

The dividend figures, to which your correspondent refers, which I used to illustrate a point in my last letter, were last year's results of two similar large electrical manufacturing concerns in Germany and England, and they represent a fair average for this particular trade at the present time.

With regard to home prices, "Troglodyte" does not seem to realise that things may be too cheap. To carry his theory to its logical limit, one must imagine what would happen if one could buy a finished article at its absolute bottom price, *i.e.*, the cost of the raw material. Nobody would get any wages, nobody would get any profits—and nobody could live!

The effect of protective tariffs may be to raise prices above the present artificially low level—I hope it will—but it must necessarily raise them in proportion to their labour-value, the tariffs being arranged on those lines.

Starting from the same cost of absolutely raw material, a little more will be added on for each process of manufacture. The result is that highly-manufactured articles (which are mostly luxuries) rise nearly in proportion to the increase of wages and profits, while those with a bigger material value (such as most necessities) do not rise so much. The net result is that the purchasing power of the individual consumer (who is in general also a producer of something else) is somewhat increased.

This is no mere theory; it has been seen working out in the States under increasing Protection, and explains why "Protection all round" has not lessened the home demand in any manufacturing country.

This is more or less a side issue, the main object of Protection being "to encourage the exchange of our manufactures for other people's raw material."

I should advise "Troglodyte" to plot the B.O.T. figures of imports for the last 20 years, as the shape of the curves clearly confirms every-day observation as regards the proportionate increase of highly-manufactured imports, with consequent gain of manufacturing profit and employment to protected countries, whence they come.

I only wish your correspondent were engaged in real business, as he would then realise the magnitude of 10 per cent. in present-day trade.

S. E. Glendenning.

Norwich, *February 26th*, 1910.

The attempt I made to reconstruct the formal arguments on which Mr. Elder based the clever rhetoric of his two former letters, has called forth a somewhat vehement disclaimer.

The disclaimer must be accepted, especially as Mr. Elder very fairly offers in return a formal proposition and a formal definition.

He states the proposition that import duties are paid by the foreigner in many cases, depending on the size of the duty, the state of the market, and the nature of the commodity. It may be granted him at once that it is not rigidly true, in the economic sense, that the foreigner never pays any fraction of an import duty, just as it is not rigidly true in the meteorological sense that rain never falls in Egypt.

The latter phenomenon is a meteorological rarity.

The former phenomenon seems equally to be an economic rarity, for the only important instance I have seen put forward is the case given by Prof. Ashley of the export of rye from Russia into the Eastern Provinces of Germany. In this case, for the period under consideration, the difference in price in the two countries was a fraction less than the whole duty.

To complete the illustration, a land agent who stated in his prospectus that there was a rainfall in Egypt, would be grossly misleading, while the meteorologist who said there was none would be guilty only of a trivial omission even were he taken in the strictest meteorological sense.

And so a politician who says that the foreigner can be made to pay part of our import duties is dangerously misleading, while the economist who says that as far as practical finance goes the foreigner cannot be made to pay is substantially correct.

The wise Chancellor, the practical business-man Chancellor, will not waste time and money hunting after rare specimens of economic reaction, he will improve Customs and Excise duties for revenue only.

Mr. Elder's proposition having been examined, his definition of Protection requires looking into.

According to the definition which I prefer, personally, Protection is the imposition of Customs duties on a class of commodity produced in the country, without a countervailing Excise duty on the home production.

Mr. Elder's definition of Protection is something much wider. It contains four conditions distinguishing an act of Protection:—

1. It is an act of a Government.
2. It is benevolently intentioned.
3. It is an interference.
4. It is purposed to support and stimulate the trade of a country in competition with other countries.

I shall accept Mr. Elder's definition for the purpose of the argument, distinguishing his "Protection" by inverted commas.

The first example he offers is the subsidising of cotton growing within the Empire.

Now, he might consistently have claimed that this is an act of "Protection" for British cotton growers. But when he says it is a measure of "Protection" for Free Trade Lancashire he trips over Condition 4 of his own definition; for, surely, the new supply of British-grown cotton will be equally available for foreign manufacturers, either directly or by releasing an equivalent amount of American, Indian or Egyptian cotton which would otherwise have been absorbed by Lancashire.

His second and third examples, the amendment of the Patent Law, and the building of light railways with the aid of grants from the Development Fund, are "Protection" consistently with his definition.

The last example, on which he asks my views, is interesting and important.

My personal opinion is that the action of the Glasgow Corporation in accepting a tender 3 per cent. or 4 per cent. above the lowest foreign tender may be good or bad business, according to the facts of the particular case. But as it is the action of a Corporation and not of a Government, it does not satisfy Mr. Elder's definition of "Protection." Nor, as there is no question of import duties, does it satisfy mine, for legal compulsion is an essential condition of import duties.

It still remains to be seen what "interference" connotes, from the particular examples put forward.

In the case of bounties, inducements are offered; in the case of the amendment of the Patent Law, restrictions on the trade of this country are removed; and in the case of a general tariff, restrictions will be imposed.

Hence "interference" is wide enough to cover any interference with the current conditions of the international market, subject, of course, to the other conditions of Mr. Elder's definition.

But never was there such interference with current conditions as the transformation of our Protective system of the thirties to the Free Trade system of the Sixties, both in the sense of removing hampering restrictions and of imposing wisely distributed burdens.

The intentions of Peel, Cobden and Gladstone were benevolent. Their purpose was to stimulate British trade in international competition. And their action was governmental.

Now, one of the favourite lines of attack of Tariff Reformers is to argue that a nominally Free Trade Government has already been responsible for measures of "Protection." This being so, they claim to be relieved of the onus of proof imposed on innovators who desire to make a fundamental change in our system of finance.

Mr. Elder's definition, so wide is it, seems to have been framed under the influence of this idea. But it is now plain that the definition is at once too wide and too narrow, for it includes the Repeal of the Corn Laws and excludes Mr. Elder's pet case of the Glasgow Corporation.

Let him try again.

Free Traders will be quite as interested as Tariff Reformers in observing how he succeeds.

Having faced Mr. Elder's able foil, let me turn to "H. S. H." and his whirling bludgeon, which now lifts him off his feet, and now comes down on his own toes.

He wants more gold bullion imports than our financial system requires in the ordinary course. But he will only undertake to eat, drink, and wear, eatables, drinkables, and wearables, which have, indeed, a gold price, but no other relation to that metal.

Let us compromise by fashioning the otherwise useless metal into ornaments, and hanging them round the necks of our female relatives, thereby satisfying at least a non-economic instinct, which we have inherited from our distant ancestors.

He asks for common sense.

But it is common sense that the sun circles daily round the earth, and it is the fruits of a peculiarly abstract science that the earth moves approximately in an ellipse, one of whose foci is occupied by the sun's centre of gravity.

It requires only a line to say that the sun goes round the earth, but it requires Newton's Principia to demonstrate the truth logically.

The same proportion holds in other sciences, hence the possible brevity of Tariff Reformers, and the necessary length of their economic critics.

A. R. Low.

Loughborough, *February 26th*, 1910.

In your issue of the 18th ult., I notice Mr. E. P. Allam states that "the Molly Maguires and the Brienites are Protectionists *to a man*." I have seen the same statement in some of the Tariff Reform newspapers, and I must unhesitatingly deny it. It is utterly unfounded in fact, and must be a case of the wish being father to the thought. There are, undoubtedly, some Protectionists amongst the Brienites in particular, and some in all classes, but when Protection is desired it is generally Protection against England, and not the Tariff Reform Commission brand. To my own personal knowledge many Nationalist M.P.'s are strong Free Traders, whilst the heads of the party have not officially declared themselves. I should be very surprised to learn that Mr. J. Redmond and his colleagues are Tariff Reformers by conviction.

Irishman.

When you kindly accepted my first letter, two very long letters had appeared on Free Trade. Your journal is well known for its Free Trade tendencies, and therefore I have nothing to apologise for, or to regret in having opened my first letter with a plain statement of fact.

With reference to coal, I am glad to have the evidence which "Troglodyte" quotes, although for me it cannot suffice, for if the coal interest really suffered, how was it that in 1903 the miners without a strike gained certain concessions that they struck for in 1898, and did not get? This does not look like bad trade, and also by how much did the Germans, Dutch and Belgians underquote the English coal before and after the Coal Tax, and what was the English market price of the undercut English coal before, during, and after the Coal Tax?

As I stated very plainly in my first letter, I am neither a Free Trader nor a Tariff Reformer, and therefore I am not satisfied either with Mr. Chamberlain's ideas or with the report of one Steamship Owners' Association, although I am quite ready to admit that the Coal Tax may not be an ideal one.

With regard to the American Mercantile Marine, most students of American history will give other causes than tariffs for the backwardness of its growth.

The war between the North and South crippled it to begin with. During the war, internal affairs had so stagnated that after it the Americans devoted all their energies to them with the result that can be appreciated to-day. So that shipbuilding, which requires long years of experience, is backward from the mercantile point of view, although I understand that American-built warships are nearly (if not quite) as good as ours.

Surely we ought to lead the world in shipping and seaborne commerce after our long years of manufacturing activity compared with many of our rivals in commerce.

As to the harm that the foreign mercantile shipping can do this country, let "Troglodyte" inquire into the terms of the "ring" controlling some of the biggest lines (is this Protection?) and see what advantageous terms the foreigners get, and let him say why.

My scorn for Mr. Kingsbury's comparisons is equal to that which I have for some arguments on Protection, and it does not prevent me from endeavouring to be an impartial inquirer.

The motor trade has caught up, so says "Troglodyte." Let him ask any candid manufacturer, and he will be told, "Yes, in quality on top prices, but low prices in bulk, viz., taxicabs, No."

One of the finest and largest motor-car factories in the United Kingdom, not very far from Glasgow, situated near the raw material most required, with low labour rates ruling, came absolutely to grief; why? because Free Trade had not caught up.

I should like to add that the road traffic legislation in the early days of the motor industry must have handicapped it severely in its development in this country.

My knowledge of the Welsh tin-plate industry is very small, but if the American tariff nearly killed it years ago, may I ask a few questions? What was the American tariff rate, and what was the home market price of the raw materials then and now?

It is a pleasure to meet "Troglodyte" in his "shirt-sleeves," but he need not have taken up nine lines of your space in hoping you did not feel hurt.

H. S. H.

The Manufacture of Cement.

I was glad to see by the letter from the Coltness Iron and Steel Co., Ltd., in your issue of February 25th, that Dr. Collossens may possibly reply to my remarks on the "theory" of the Collos proccess.

With regard to the Coltness Co., let it be at once understood that I did not wish to belittle their most laudable spirit of enterprise in taking up such a question as that of making cement from blast-furnace slag in such a vigorous manner. On the contrary, they have my whole-hearted sympathy and admiration. Cement is, however, an article the qualities of which are of interest with regard to the public safety as much as in relation to commerce, and

theories and explanations are hardly sufficient when not supplemented by facts. We are informed that thousands of tons have been made and sold. Might I ask, in the interests of engineers in general, the following questions:—

1. Does the Coltness Co. manufacture Collos cement without adding lime?

2. Given a bulk sample of Coltness cement stored in sacks for two months, how does it come out:—(*a*) For specific gravity? (*b*) for setting time? (*c*) for the usual set of neat tests for tensile strength?

3. Will the Coltness Co. supply me and another expert of their own in London with a sample for division between ourselves, in order to allow us to make corresponding experiments?

For the information of my engineer friends, I wish to state that sand tests for slag cement are somewhat misleading, as all such cements have somewhat abnormal surface adhesion to smooth objects.

It is naturally at the option of the Coltness Co. to disregard my queries, but the question is of such enormous importance that I feel the public in general would be served by a satisfactory answer to my questions.

John Rhodin, F.I.C.

London, S.W., *February 28th*, 1910.

Cinematographs.

In reference to the recent correspondence in your columns relative to the Cinematograph Regulations, it must be pointed out that, although Clause 6 (c) may have been originally framed to avoid the use of large resistances, yet it is obvious that auto-connected motor-generators cannot be installed where they have to work across the outers of a three-wire system of 400 volts and upwards, with the neutral earthed. That is, of course, assuming that the official definition of pressure is adhered to—*i.e.*, pressure between the leads or to earth.

There seems no reason whatever why the limiting pressure with converting machinery should not be 250 volts, as specified by the L.C.C. Rules, as there is far less risk of fire than with the regulating resistances. There have been repeated attempts to obtain a correct interpretation of the above clause, and the only one at present forthcoming is that the pressure of 110 volts is to apply only when the arc is burning. This reply, however, does not in any way make the matter clearer.

It is obvious that the fire risk is reduced to a minimum when the lamp is supplied by a machine such as the well-known C.M.B. auto-converter manufactured by Messrs. Crompton & Co., Ltd., which has been frequently referred to in your columns. This type of converter is largely used in modern bioscope installations employing continuous current. It is designed with a drooping characteristic which prevents the normal current being exceeded by more than a small percentage, even when the leads supplying the arc are short-circuited, the voltage immediately falling to zero. On opening circuit the secondary pressure is slightly higher than the normal working pressure, the latter usually being about 50-60 volts, and this low pressure is permissible, owing to the fact that no steadying resistances are necessary as the converter automatically controls the lamp. In order that the C.M.B. auto-converter may conform to the limiting pressure of 110 volts, it is designed to work on the inner or on the outers of any three-wire system. When supplied from the outers, the secondary leads are entirely isolated from the supply leads. The efficiency, however, in this case is considerably lower than when the converter is interconnected and is supplied from the inner and one of the outers. The machine can also be arranged for belt driving as a simple self-regulating generator, and steadying resistances are unnecessary.

It is to be sincerely hoped that the present requirements, as far as they concern certain electrical installations, will soon be revised, as at the present moment the L.C.C. requirements on the limiting pressure are over-ruled by those of the Home Office, the vagueness of which has caused considerable inconvenience both to electrical contractors and to manufacturers.

J. H. Johnson, A.M.I.E.E.

London, *March 1st*, 1910.

Being uncertain what interpretation to put upon Regulation 6 (c), "No current at a higher pressure than 110 volts shall be used within the enclosure," we wrote to the Secretary of Scotland asking if it would satisfy the conditions if a supply were taken from a circuit of higher voltage than 110, and a resistance introduced into the circuit outside of the enclosure, so that when the current is passing the difference in potential between any two points within the enclosure will not exceed 110 volts.

In reply, we were informed that "The conditions of Regulation 6 (c) will be complied with if, when the cinematograph lamp is working, the pressure across the terminals of the double-pole switch inside the enclosure does not exceed 110 volts."

J. McMillan,
Burgh Electrical Engineer.

Falkirk, *February 28th*, 1910.

[For the revised Cinematograph Regulations see our "Notes" to-day.—Eds. E.R.]

THE JAPAN-BRITISH EXHIBITION.

Once more we return to the subject of this Exhibition in the hope that some of our manufacturers, especially those engaged in the electro-technical industry, will bestir themselves to make some sort of an exhibit before it is too late. We fear that but few realise that there is a moral obligation upon the principal manufacturers of this country to participate in the Exhibition which should open on May 3rd, for Japan is sending from afar of her very best to make the finest show she has ever put together at home or abroad.

We need scarcely say that our frequent allusions to the desirability, indeed we might say the absolute necessity, of England bringing together something worthy of her world-wide reputation, are made quite disinterestedly so far as we are personally affected, our one concern being for the welfare of our industries in general and the electrical in particular.

The Exhibition has more than a mere pecuniary phase for its immediate object. Britishers will have future commercial advantages by showing their electrical productions at the White City, for influential would-be buyers are coming over, such as (1) owners of factories; (2) representatives of different firms; and (3) delegates of large manufacturers' organisations.

There will be a great opportunity of establishing direct trade between Japan and this country, and our business-like visitors will arrive with the expectation of finding all they desire at the Exhibition, for they will be too busy to make a tour of the country, and they hope to have the advantage of seeing examples of what we can offer all on one spot.

There is great demand for electrical machines and appliances in Japan for the needs of electric light companies which in the past have grown very rapidly, and there is room for much greater development. The industry will steadily grow in the future, for in Japan electric light can be cheaply supplied, and the companies are looked upon as capital investments and pay good dividends of from 8 per cent. to 20 per cent. Even that of Nagano declared 14 per cent. last year.

Electric railway companies will require more plant, for these undertakings have prospered and offer excellent prospects. In January, 1904, the total length of tramways in Japan was 38 miles; in January, 1908, 119 miles, with 17 electric railway companies having an aggregate capital of about £8,150,000; and in January, 1909, 317 miles with a few more companies, and others are now under way.

Generally speaking, these do not pay so high a dividend as electric light companies, but some are said to have paid even as much as 30 per cent.

It is believed that water-power electric plants will develop greatly in Japan, the country being mountainous, with fast flowing streams, and therefore well suited for such developments.

As a matter of fact, the greater part of the electrical energy now being utilised in Japan is produced by water-power, coal and other fuel being comparatively costly in most parts of the country.

With the growth of factories more demand is being made

on electricity as a motive power, for in Japan the industries generally are changing from the hand to the factory system, and the number of factories using electricity have been increasing rapidly, especially during the last few years.

A large amount of electrical machinery is imported yearly from foreign countries; for instance, motors and dynamos imported in 1908 reached the sum of £210,000; all other electrical machinery totalled about £167,000, and telephones about £11,500.

Japanese eyes are now turned towards Great Britain for the supply of electrical appliances more earnestly than ever before, for they appreciate more and more the high quality of workmanship in British machinery, for (1) the machines get out of order comparatively seldom; (2) they are more easily repaired and manipulated; and (3) they are durable. Our allies also acknowledge the high standard of business practice of Englishmen, and since the alliance the general feelings of the people are very favourably disposed towards this country.

The list of general engineering appended hereto, together with a supplementary schedule of other articles, will, we believe, find favour with Japan.

General List of Suggested Exhibits.

Equipment for electric generating stations, both steam and water power.

Electrical transmission plant; aerial and underground.

Electric motors, lamps, furnaces, ventilators, ozonisers, clocks, pyrometers and instruments; switchgear of all kinds.

Telegraph and telephone apparatus (including wireless telegraphy).

Machinery for general industrial purposes, particularly textile machinery; iron and steel works machinery; shipbuilding plant; armour plate, gun and cartridge-making plant; automatic machine tools; flour and maize milling plant; agricultural machinery; cable-making plant; brick and pipe making plant; gold mining plant, &c.; structural ironworks for bridges, buildings, cranes, &c.

Railway and tramway material generally.

Plant for municipal use in sewage disposal; refuse destructors; street lighting; water purifying plant.

Electro-chemical plant suitable for use in connection with water power development, and in the making of artificial manures.

Lighthouse plant.

Gas engines, gas-making plant, oil engines, and by-products recovery plant.

Colliery and mining machinery; winding, pumping and ventilating plant.

Motor-cars.

Some of the machines and machinery that are likely to find a ready market in Japan:—

Envelope-making machinery, chain-making machinery, tools for gold and silversmiths, book-binding machines, machinery for carpentry, cardboard-box making machines, tinplate embossing machines, paper embossing machines, leather tanning machinery, machine for making metallic ribbon for stained glass, paper-making machinery, textile printing machinery, canning machinery, knitting machines, machines for making chain bags, &c.

We may add here that simple and handy machinery is more suitable to their markets than that of a heavier and more complicated nature.

As already intimated, Japan is going through a period of transition, going from hand to machine, from the family to the factory system. In her industries this is specially marked, but in most localities under the present industrial and social conditions of her national life small and simple machines and tools are in greatest demand. Our visitors not only expect to find a display of this nature worthy of British enterprise, but they will look for such principal products of the old country as textile and leather goods, gold and silver ware, wool and cotton fabrics, and cutlery, and it is believed that manufacturers of these articles will not find themselves losers by exhibiting of their best at the White City.

The pleas put forward for declining to exhibit on the part of certain firms are too transparent to be treated seriously. "If we show our apparatus," say some, "the Japanese will only copy them and manufacture for themselves!" The Japanese need only buy what they wish to imitate—and the firms which will not exhibit are perfectly ready to sell—and the thing is done! Non-participation in the Exhibition will not deter our allies from making themselves masters of anything they wish to manufacture in their own country, for the means of so doing are plentiful!

Finally, we cannot do better than quote from "A Londoner," who wrote a very exhaustive article on this magnificent enterprise in the *Daily Telegraph* of February 18th, and with whose comments we are in entire agreement. Said the writer:—

Never before has there been such active preparation for an exodus towards London by Continental railways or trans-Atlantic shipping companies as this momentous Exhibition has called forth. We can only hope that our manufacturers will rise to the challenge, and that, when the day of opening comes, there will not be a grim and significant contrast between the dainty and perfectly displayed stalls of our Eastern allies and the usual desolate, packing-case-littered galleries which have hitherto seemed inevitable on the opening day of an exhibition of British work. . . .

From the commercial point of view, it would be mere foolishness for an enterprising manufacturer to lose the chance offered by this Exhibition. It will attract crowds to London, such as not even the Franco-British Exhibition drew. It has only to be realised for its success to be complete. . . .

For the common credit of our race and industry let it be impressed upon every exhibitor that nothing will be more unfortunate for our prestige than an opening day which should merely contrast the clean, quick, punctual, businesslike activity of the Japanese in these affairs with our own almost proverbial unreadiness. At this moment the Japanese, should it be necessary, can see their way to be entirely ready, down to the last showcard, three weeks before the date announced for the opening of the Exhibition. Is it impossible that the British sections should also be far enough advanced to challenge in the matter of preparedness also a rival the importance of whose competition in our own especial industries is at last to be fairly and directly tested?

When the meeting of the General Committee was held at the Mansion House on December 22nd last, a resolution was passed pledging the members of the Committee to use their influence with the principal manufacturers of the United Kingdom in order to obtain such comprehensive exhibits as would make the British section worthy of the occasion. As a result of this, the Exhibition authorities received a letter from Mr. Charles E. Musgrave, secretary to the London Chamber of Commerce, in which he said:—

I beg to inform you that at the meeting of the Manufacturers' Section discussion took place as to British representation at the Japan-British Exhibition, when the following resolution was unanimously agreed to: "That this meeting recommends British manufacturers generally to consider favourably the desirability of being represented at the Japan-British Exhibition, having regard to the exceptional representation of the Japanese."

Mr. Mordey, too, as chairman of the Electrical Engineering Committee of the Exhibition, has sent out nearly 500 letters to the electrical manufacturers of the United Kingdom, a copy of which appeared on page 302 of our last issue.

It would be highly edifying to know what effect, if any, these recommendations have had upon the innate immobility of our industrial and engineering representatives.

LEGAL.

Sunderland Borough Council and Sir James Laing & Sons.

Mr Justice Neville, sitting for the disposal of company business, heard a summons by the Borough Council of Sunderland, asking in effect to be admitted as creditors of Sir James Laing & Sons for a sum of £22,500 in respect of a contract for the supply of electricity to the respondent company.

Mr. Whinney appeared for the Council, and the company was represented by Mr. Gore Browne, K.C.

At the outset Mr. Justice Neville asked whether the company was in liquidation.

Mr. Whinney said that his Lordship might take it that it was. There had been a voluntary liquidation, but not under supervision of the Court, and he understood that there was now a scheme of reconstruction. The present summons was a summons calling upon the liquidator to admit proofs for £22,500 in respect of an alleged breach of its contract made prior to June, 1907, by which the company agreed to take electricity from the Council for 15 years at a minimum rent of £1,500 a year. The main question between the parties, was whether there was in fact a contract which the Council could rely upon. The rent was in the nature of payment for plant which had cost the Council £21,000, and had been put up for the purpose of making the supply. The Council's original proof was for £4,955 for electricity actually supplied, and that was practically admitted subject to a possible adjustment. That, however, was a very small part of their present claim, and they would, of course, have to give credit for the £4,955, against the £1,500 a year. The agreement in respect of which the claim was made, was never executed under seal of the Council, but his submission was that there was a sufficient contract contained in the correspondence between the parties, and the difficulty of not being under seal was got over by a part performance by the company. The Council erected the plant at the request of the company, had commenced the supply, and had continued the supply until a short

time before the winding-up. Under Sec. 21 of the Council's Provisional Order, the undertakers were bound to supply electricity, and they might, if they thought fit, call upon persons requiring a supply to enter into a written contract with them to make payments for a supply equal to 20 per cent. of the outlay incurred by the undertakers.

Mr. Justice Neville: The outlay for supplying electric lines—not the machinery.

Mr. Whinney: For extending the mains, really.

Mr. Gore Browne: Not the generators.

Mr. Whinney said that he was not called upon to dispute the matter, because they could make any agreement they liked. In the year 1905 the company claimed to be supplied with electricity by the Council, and on March 25th, 1905, an agreement was entered into for a supply up to 250 kw. for motive power and 100 kw. for lighting. About that agreement there was no dispute. There was also another agreement for a temporary supply to the Receiver, about which there was no dispute. In 1907, however, the company wrote to the Council to the effect that they required further plant. The letter was dated February 19th.

His Lordship: Is it for energy and power?

Mr. Whinney said it was. The company wrote that they found, after all, it was necessary to provide further power, and they desired to know whether the Council would supply further machines.

His Lordship pointed out that the Council must have an agreement in writing.

Mr. Whinney submitted that part performance was an answer to the Statute of Frauds. The company were seeking to deprive them of what really was payment for work they had done as they had had to incur a very large expenditure in order to give the supply. Instead of taking a guarantee from the company as they were entitled to do under their provisional order, they agreed that the company should pay £1,500 a year at least, whether they took the energy or not for a period of 15 years. His submission was that the Council had done all that was required of them

Mr. Gore Browne said there was no contract in writing and no suggestion of one.

Mr. Whinney submitted that there were letters that passed between the parties and amounted to a contract, though no doubt the acceptance was oral; the £1,500 a year was to recoup the Council for any profits they might loose by reason of the company not taking a full supply of electricity, the Council had power under their provisional order to have required security.

Mr. Gore Browne said that, even assuming a contract, if there had been any breach, it was by the Corporation, for they cut off the supply.

Mr. Whinney said that what happened was, the company gave the Council notice that they were going to suspend payment; the Council thereupon demanded security, which was not forthcoming, and then, without waiting for the expiration of the statutory seven days, they cut off the supply. The Council were under an obligation to supply the company at 2½d. a unit for a supply up to £2,000 a year, and if the company did not take electricity to that amount they were to pay £1,500 a year for 15 years.

His Lordship asked, if the Council were entitled to damages, did they claim the value of an annuity of £1,500 a year for 15 years?

Mr. Whinney thought the proper measure of damage would be the full amount, less a rebate of 5 per cent.

Mr. Gore-Browne said the real point was whether there was an agreement in the letters. The Corporation never expressed its consent to the contract at all. All there was was a letter from an official which asked the company whether certain terms were acceptable to them, in which event the Council would give the supply.

His Lordship held that the fact that the agreement was really for payment for a term, the date for the commencement of which term was not fixed by the parties, was fatal to the contention that there was a concluded and binding agreement, and the summons must be dismissed with costs.

Curious Tramway Dispute.

The case of Medley *v.* London United Tramways, Ltd., concluded this week; the jury found a verdict for the plaintiff, awarding him £450 damages against the London General Omnibus Co., and his Lordship entered judgment accordingly. He also awarded costs against the 'bus company, and directed that they should include the costs of the L.U.T. Co., who were joined as defendants to the action.

The Electrical Co. Ltd., *v.* Thomas, Son & Co.

During the week the Official Referee (Mr. Pollock) continued the hearing of this case and exhaustive evidence was taken as to the extent the mine had been worked for coal, the accuracy of the plans submitted, &c.

Mr. Thomas, jun., concluded his evidence, and Mr. Oliver Hugh Thomas, previous witness's father, was called. He stated that he carried on business as colliery-proprietor under the style of Oliver H. Thomas, Son & Co. He held a lease of the mine in question. Witness gave evidence as to his outlay for the purpose of sinking down to the coal seams at the mine, and the purchase of the necessary plant. In 1900 he put in a steam plant, but when the mine became flooded out in 1905 he consulted Prof. Galloway, and decided to lay down an electrical pumping plant. The coal market at the time was rising rapidly, and he negotiated with the Electrical Co. for the plant, impressing upon them the necessity of expeditious delivery and installation of the machinery. Plaintiffs assured him that no one could do it better than they could, and the time fixed for delivery was six weeks and a further three weeks for erection. Witness then repeated the story of the delays, &c.; when the mine was again flooded he told Mr. Stottner that he had better take the plant away, because he was sick and tired of the whole business. Mr. Stottner, said witness, was then very eloquent about the reputation of their firm, and said it would be a serious matter for them; he suggested that they should again attempt to unwater the mine, and defendants allowed them to take the work in hand under the fresh agreement which had been mentioned.

The hearing was then adjourned until April 5th.

Irving *v.* Bodie.

The Master of the Rolls and Lords Justices Fletcher Moulton and Farwell, on Thursday, February 24th, dismissed the appeal of "Dr." Walford Bodie, medical electrician, from a judgment of Mr. Justice Darling, of the finding of a common jury awarding the plaintiff £1,000 damages.

The Master of the Rolls, in the course of his judgment, said that there was evidence that the defendant was an unscrupulous quack, and the verdict of the jury was amply justified.

Donnersmarckhutte Oberschlesische Eisen und Kohlenwerke A.G. *v.* The Electric Construction Co., Ltd.

In the Chancery Division on Monday last Mr. Justice Parker delivered his reserved judgment in this action.

Mr. Justice Parker said this was an action for infringement of Letters Patent No. 7,188 of 1902, for Improvements in Means for the Control of Electrically-Driven Reversible Rolling Mills. The defendants denied the infringement, and contended that the Letters Patent were invalid on various grounds, of which the most important was want of subject matter. He reviewed the technical points involved, and then turned to Ilgner's specification, the objects of which were (1) protection of the source of supply from the sudden demand entailed in starting the motor; and (2) economy in controlling the motor. His Lordship thought, having regard to the claim at the foot of the specification, that the economy referred to was an economy secured by avoiding the rheostatic system of control. In order to obtain these objects, the current was not delivered directly to the rolling-mill motor, but by the intercalation of a motor-dynamo which was to be connected with a suitable fly-wheel, and was to be in operation as long as the rolling was to be carried on. The motor of the motor-dynamo was to be so constructed that the motor could not race, and that with an increase of load a reduction in the speed took place. This direction appeared to exclude series-wound motors, and shunt-wound motors constructed as such machines usually were, and seemed to point either to a compound winding, or to a shunt winding deliberately so arranged as not to secure that constancy of speed which all makers had been aiming at and had approximately attained. The next paragraph of the specification in effect said (1) that the dynamo was to be constructed in such a manner that any change in the excitation caused an alteration in the difference of potential at the terminals of the dynamo, and (2) that the operation of starting the rolling-mill motor and its adjustment to the required number of revolutions was effected by the variable adjustment of the field-magnet excitation. This suggested the Ward-Leonard system, involving (though it was nowhere so stated) separate excitation of the fields of both the dynamo and the working motor. The next four paragraphs of the specification described the way in which the invention operated, and were reasonably clear. The last two paragraphs of the specification called attention to the fact that if the rolling-mill motor and the intermediate dynamo were constructed as continuous-current shunt machines they got an efficient brake. These paragraphs were the subject of some criticism, well founded if the expression "shunt machines" connoted shunt excitation, but if separate excitation was contemplated, the expression, though not strictly accurate, might reasonably be thought to refer to the method of winding rather than to the source of excitation. The specification as a whole, though clumsily framed, might, he thought, fairly be construed to direct that in working reversible rolling mills electrically they were to adopt the full Ward-Leonard system for the sake of economy, and put a fly-wheel on the intermediate dynamo in order that any extra demand required to be made on the source of supply might be made gradually only, the extra power required being meantime supplied by the fly-wheel. There were other advantages to be derived from the idea of a fly-wheel so applied, though they were not in any way mentioned or referred to by the inventor; thus, the periods of heavy load in a rolling mill being exceedingly short, a fly-wheel could easily be constructed as to supply the extra power required without making any very greatly increased demand on the source, and if this could be done it followed that the intermediate motor could be a much less powerful motor than the working motor. In applying the Ward-Leonard system without a fly-wheel the intermediate motor as well as the working motor would (except so far as the dynamo itself were capable of a fly-wheel effect) have to be of the same strength as the working motor, that is to say, of a strength sufficient to cope with the maximum load. Further, with a regulator in the field of the intermediate motor the increased

demand could be prevented altogether from coming on the source and not be brought gradually only on the source. These advantages, though not mentioned by Ilgner, were relied on as showing that the idea of combining a fly-wheel with the Ward-Leonard system was an exceedingly valuable one. The essential feature of the invention disclosed by the specification as thus construed lay in the idea of putting a fly-wheel on the intermediate motor of the Ward-Leonard system of control as applied to reversible rolling mills, the only practical direction for carrying the idea into effect being the direction as to the motor of such dynamo being so constructed as to slow up with an increased load, which was an obvious necessity, if the fly-wheel was to act at all. The question of infringement depended on whether the defendants had taken and used, and the question of subject-matter depended on whether it required invention to arrive at, this idea. The defendants had taken the full Ward-Leonard system and put a fly-wheel on the intermediate dynamo. They did not, however, secure the drop of speed in the intermediate motor by winding its magnets in any particular way. They took an ordinary shunt-wound machine with a drop of from 2 per cent. to 5 per cent. between no load and full load, a drop which was not enough to enable an ordinary sized fly-wheel to do the work required, but they had an automatic regulator in the field circuit of the intermediate motor which came into operation when the demand for power reached a predetermined maximum. When this maximum demand was reached the regulator automatically increased the strength of the field of the intermediate motor, thereby increasing the back electromotive force and causing the motor to slow up, and the resistances were so arranged that there was no demand on the source in excess of the predetermined maximum. In other words, when in the operation of rolling the ingots there was the usual sudden demand for an enormous horse-power, such demand was not, as contemplated by Ilgner, thrown gradually on the source of supply, but was prevented altogether from going back on the source of supply, the weight of the fly-wheel and the reduction of speed in the intermediate motor being so arranged that all power beyond the predetermined maximum was supplied by the fly-wheel. Under this arrangement the only variations of demand which could come back on the source of supply, and which came back gradually because of the fly-wheel, were those small variations, if any, which occurred before the demand reached the predetermined maximum, and it was even doubtful whether the fly-wheel was operative in these cases, because the fly-wheel effect of the dynamo without the fly-wheel might be sufficient. His Lordship was, however, of opinion that if Ilgner's patent were valid the defendants had taken the substance of his invention. They had added a fly-wheel to Ward-Leonard's intermediate dynamo. They had constructed the intermediate motor in such a manner as to secure a reduction of speed with increase of load, and in this way they supplied extra power from time to time required by the working motor, and to the extent of the power so supplied relieved the source of supply. He must, therefore, proceed to consider whether Ilgner's patent was valid. Of course, long before 1902 the uses of, and the mechanical principles involved in, the action of a fly-wheel were well-known. One well-known use was to store up in times of light load energy which could be utilised in times of heavy load, so that, for example, a machine capable of developing 1,000 H.P. only, might, with the aid of a fly-wheel, develop, to meet short periods of heavy load, many thousand horse-power seconds. Before 1902 the fly-wheel had been applied as one would expect in connection with electrically-driven machinery. A good instance of such a fly-wheel being placed on the steam engine occurred in the haulage plant used by the Trafalgar Colliery Co., Ltd., and dynamos with a fly-wheel (fly-wheel dynamos, as they were called) were well known. There could have been no invention, therefore, in applying a steam engine and fly-wheel dynamo to drive any motors the load on which was variable, or variable and reversible, and the operation of such a fly-wheel would be independent of the system of control adopted in working the motor; nor after Ward-Leonard could there have been any invention in controlling the working motor through the field of the dynamo. This was the method of control adopted in the haulage plant to which he had referred. It was, of course, true that a fly-wheel dynamo could only be used, just as the simple Ward-Leonard system of control through the field of the dynamo could only be used, where the dynamo was under the command of the person who controlled the motor. The question of subject-matter reduced itself to the question whether any invention was involved in the recognition that Ward-Leonard's intermediate dynamo made it possible to use a fly-wheel in the case of motors the loads on which were reversible and which were driven by current supplied by some central station. It seemed to him that this must have been fairly obvious. When the idea of an intermediate motor and dynamo, to get rid of the difficulty in controlling a motor through the field of the dynamo where the motor was driven by current derived from a central station, had once become common property, he did not think there could have been any invention in applying the idea to get rid of the analogous difficulty of attaching a fly-wheel to the dynamo under similar circumstances. Looking at the question from a slightly different point of view, it appeared that in 1895 Mr. Ferranti patented an invention (No. 4,065 of 1895) for improved means of working and supplying current to electric tramways and lifts, the latter involving loads which were both variable and reversible, and therefore analogous to the loads of reversible rolling mills. Mr. Ferranti interposed between the source of supply and his working motor an intermediate motor and dynamo; he chose a motor for the combination which would slow up with increase of load, and placed on the shaft of the combination a heavy fly-wheel. Ferranti did not specify how his working motor was to be controlled, and his Lordship did not think it was necessary to do so, for, whatever system of control were adopted, the operation of the fly-wheel would be the same. He said that his invention could be used for supplying any circuits where the demands were irregular or sudden and where it was desired not to interfere with the regularity of the primary source. There seemed no reason why, if he had liked, he should not have applied it to a reversible rolling mill. If he did so, of course he would have to adopt some system of control for his working motor, and if he had adopted the Ward-Leonard system he would have arrived at the precise combination protected by Ilgner's letters patent. From this point of view, the question of subject matter reduced itself to the question whether there would have been any invention if Ferranti, in applying his machine to a reversible rolling mill, had seen fit to adopt the Ward-Leonard system of control. In his Lordship's opinion, this system was the obvious system to apply. It was not, and could not be, contended that there was any invention in carrying the idea into effect, and he did not think the combination really led to any new result. He was inclined to think that the real reason why reversible rolling mills were never run electrically till a date some time after Ilgner's patent was because motors strong enough and electric plant big enough for the purpose had not yet been brought to the requisite state of perfection; and it was noticeable in this connection that till recently electricity had not been applied to rolling mills which did not involve reversing the direction of rotation, and where, therefore, a fly-wheel might have been placed on the working motor. As soon as electric motors and plant had reached that state of perfection which admitted of their application to and use for machinery requiring such enormous horse-power as a rolling mill, it appeared to him that any competent electrical engineer would, without any aid from Ilgner, see (1) that the only practicable system of control was the Ward-Leonard system; and (2) that, having regard to the nature of the load, a fly-wheel was desirable, the difficulty of using a fly-wheel in the case of reversible loads, when the current was supplied from a central station, being got over by the interposition of Ward-Leonard's intermediate motor and dynamo. The power of keeping the speed of the working motor constant by regulating the voltage at the brushes of the intermediate dynamo was a well-known advantage of the Ward-Leonard system, and he did not think there was any invention required to see that the power could be exercised to counteract any falling-off in speed of the working motor, however such falling-off was caused. He had come to the conclusion, therefore, that the patent in question was invalid for want of subject-matter, and that the action failed.

Mr. Bousfield asked for costs, which were granted.

Babcock & Wilcox *v.* Spearing.

In the Court of Appeal on Monday Lords Justices Vaughan, Farwell and Kennedy concluded the hearing of the application by the defendant in this action for judgment or a new trial of the action which was tried before Mr. Justice Darling and a special jury. The circumstances of the action are familiar to our readers. At the conclusion of the arguments of counsel, after some discussion, the Court ordered a new trial, the defendant, through his counsel, undertaking not to carry on the manufacture of any water-tube boilers in competition with the plaintiffs, but that was not to prevent the defendant from selling or undertaking the sale of water-tube boilers, manufactured, or to be manufactured, by any other person or company. The defendant was given the costs of the appeal, and the costs of the first trial were to abide the result of the second.

Forde *v.* Edwards.

According to a newspaper report, on 25th ult., at the Kent Assizes, Mr. Joseph Forde, manager of the Isle of Thanet Electric Tramways Co., sued Mr. William Henry Edwards, ironfounder, of Ramsgate, for damages for libel. The plaintiff had occasion to reject certain castings made for his company by the defendant, and some months later defendant sent two letters to a shareholder of the company, in which he made several serious allegations against plaintiff, which constituted the libel. The plaintiff in the box denied the allegations *in toto*, and the jury at once found for him and awarded him £100 damages.

The British Aluminium Co., Ltd.

In the Companies' Winding-up Court, Mr. Justice Neville had again before him petitions presented by Dick, Kerr & Co., Ltd., and A. Schonfield & Co., for the compulsory winding-up of the British Aluminium Co., Ltd.

Mr. A. G. Wright said he appeared with Mr. Martelli, K.C., for the petitioners, on first petition, who were creditors, because he had been given to understand that the company had proposed a scheme of reconstruction, they had held the necessary meetings, and there was a proposal to pay the unsecured creditors in full. The necessary resolutions for the purpose had been passed, but a certain time was required for carrying out the scheme, and on behalf of the first petitioners he had no objection to further time being given.

Mr. Kirby (who with Mr. Younger, K.C., appeared for the company) said that things had been proceeded with to a great extent, and all the necessary meetings had been held. The new company had not been registered, but it would be done, and

he asked that the petitions might stand over for two months. There would be no unnecessary delay in the matter.

Mr. Gore Browne, K.C., for the second petitioners, said that after what had fallen from Mr. Kirby, he did not propose to press on his petition. It was stated that the scheme would provide for the payment of the unsecured creditors in full, and as his clients were unsecured creditors it was worth while running some little risk.

Mr. Justice Neville accordingly directed both petitions to stand over until the first petition day in May next.

Anderson *v.* Federated Steam Navigation Co.

In the Nisi Prius Court at the Liverpool Assizes on Friday, Thos. Anderson, Ltd., electrical engineers, sought to recover about £337 by way of indemnity against the Federated Steam Navigation Co., Ltd. Mr. W. F. Taylor, K.C., and Mr. Greaves Lord were counsel for the plaintiffs, and Mr. Horridge, K.C., and Mr. Segar for the defendant company. On May 27th last an electrician named Hilliard, in the service of the plaintiffs, was working on board the steamship *Somerset*, belonging to the defendant company, in the Brocklebank Dock, when he fell down a hatchway into the hold, and was killed. His relatives secured an award of the County Court for £300 under the Workmen's Compensation Act against the plaintiffs. By the present action they sought an indemnity against that payment, alleging that the fatal accident was caused by the opening through which Hilliard fell being imperfectly covered.

Defendants denied negligence, and also said they were not liable by reason of an indemnity alleged to have been given to them by the plaintiffs.

The jury found for the defendants, and judgment was given accordingly.

POST OFFICE ENGINEERING DEPARTMENT, LONDON.

The seventh annual dinner was held at the Hotel Cecil, on the 15th ult., Major O'Meara, C.M.G., Engineer-in-Chief, presiding.

After the loyal toasts had been duly honoured, the Postmaster-General said that was the last time that he would be present in that capacity, and he thanked the Department for the hearty support accorded to him during his four years' tenure of the office. He proposed "The Engineering Department," and remarked that he had to congratulate them on the completion of the revision; the number of first-class engineers had increased by 37 per cent., and all first-class engineers in charge of sections were now on terms of equality. There had also been an increase of 35 per cent. in second-class engineers. The Telegraph Construction Act had been of very considerable advantage to the Department. He referred also to the acquisition of the internal wireless system for £15,000, the approaching transfer of the National Telephone Co.'s system, and the forthcoming conference in Paris with regard to telephone and telegraph work. Since the taking-over of the telegraph system, just 40 years ago, the mileage of land wire had increased from 60,000 to over a million miles, and the engineering staff from 630 (in 1873) to 2,900—a wonderful development.

Major O'Meara, Engineer-in-Chief, in responding to the toast, stated that the P.M.G. had nominated eight officers of the Engineering Department to attend the Conference; only three were at the Budapest meeting. He expressed his appreciation of the courtesy he experienced on his recent visit to the United States, where he discovered, to his surprise, that the telephone art was still in a state of flux, and developments might take place in a short time even more radical than the change from the magneto to the C.B. system. In America engineers had risen to very high positions as administrators; they had to be more than mere technical men nowadays, and they ought to develop their administrative faculties, as their American *confrères* did. The boast of the engineer that he had created modern civilisation on its material side was fully justified.

Mr. Moir proposed "The Visitors," and, referring to the membership of the Institute of P.O. Electrical Engineers, which numbered 800, and was somewhat too large for the Northampton Institute, he suggested that in the future it might find accommodation in the building of the I.E.E.

Sir Robert Hunter, in responding, remarked that while all other branches of the Post Office developed apace, his own small twig was almost stationary in growth; that was as it should be—when lawyers were busy it showed that someone had bungled, either in legislation or in application of the law. This was the age of science and its applications, and by facilitating intercourse they were helping to make human life healthy and happy in the pursuit of high ideals.

Dr. G. Kapp also responded, regarding the Engineering Department as the "godfather" of the I.E.E., and tracing its universal influence upon the progress of electrical engineering, together with the reciprocal advantages derived by the Department from the heavier branches of electrical engineering. He felt confident that if it became necessary the I.E.E. would give them hospitality.

Mr. H. C. Gunton proposed "The Chairman," who, he said, was working not only to maintain but to improve the status of the engineer in the Post Office. He had had experience in contact with the staffs of railway companies, municipalities and large contracting firms, and found that the work of the Post Office engineers was greater in volume, and quite as efficiently performed, but less recognised, as compared with outside concerns. The Post Office power and lighting circuits consumed 5,400,000 units a year derived from outside sources, and 5,000,000 units generated by their own plant, which was of 7,000 h.p. The work of the power engineer would be very prominent in the new King Edward Building. They had electric lift motors of 750 h.p. installed, and 550 h.p. on order. Fortunately they had a chief who fully sympathised with their difficulties and responsibilities.

Major O'Meara briefly replied, expressing his confidence in the support of the staff.

BUSINESS NOTES.

Bankruptcy Proceedings.—Alfred Ernest Felgate and William Storey (trading as Felgate & Storey), electrical engineers, 10, Queen Victoria Street, Reading.—The first meeting of creditors herein was held last week at 14, Bedford Row, London, W.C. The statement of affairs showed gross liabilities of £3,012, of which £2,412 was due to unsecured creditors. There were fully-secured creditors for £250, but the value of the securities therefor showed a surplus of £125, which was carried out as an asset. The claims of the partly-secured creditors totalled £245, the estimated value of the securities being £40, thus leaving a balance of £205 to rank for dividend, making total liabilities to rank for dividend £2,617. The assets were estimated to produce £969, from which had to be deducted £105 for preferential claims, leaving net assets of £863, or a deficiency of £1,754. It appeared that the debtor, Felgate, started business in 1903 at Reading, with a borrowed capital of £130, for which he gave as security some shares in the Speedwell Cycle Co., Ltd., which shares eventually realised 2s. 6d. in the £. He also borrowed a further £600, which is still owing. In 1907 he opened the shop in Woodstock Road, Oxford, and in January, 1908, Mr. Storey joined him in partnership, putting £250 into the business at the time, and a further £250 at the end of the year. He was to have one-third share of the profits, and a larger share if he brought in more capital. Mr. Storey borrowed the money from his cousin, and it is still owing. They had personally superintended the business. The failure is attributed to bad trade, heavy rent, and loss on the Oxford shop. After a long discussion, it was decided to appoint Mr. E. P. Allnutt, accountant, of 2, The Forbury, Reading, as trustee of the estate, to act under the supervision of a committee of inspection, which was also appointed. The following is a list of creditors:—

British Ever-Ready Co	£18	Tucker & Co.	£11
British Thomson-Houston Co.	73	Veritys, Ltd.	74
Baughan & Co.	79	Bonnella & Sons	10
Broome & Wade	13	Jacobs, W. and R.	12
Cooper & Cooper	16	Siemens Bros. & Co., Ltd.	10
D.P. Battery Co.	38	Fulder, J. C. (exors.)	115
Enterprise Electric Co.	50	Cutting, H. G.	61
Edison & Swan Co., Ltd.	38	Cutting, A.	195
Falk, Stadelmann & Co.	16	Cutting, Mrs. A.	208
General Electric Co.	86	Davis, J.	50
Gent & Co.	24	Felgate, Mrs.	40
Henleys, Ltd.	140	Storey, H. L.	550
Krupka & Jacoby	13	Storey, H. L.	60
Marshall, P., & Co.	18	Storey, H. L.	13
Metallic Tube Co.	122		
Rotherham Education Committee	50	Partly secured creditors (security, £40)	245
Reason Manufacturing Co., Ltd.	12	Fully secured creditors	250
Reading Electric Supply Co.	15	Preferential creditors, rent, £73, wages, &c., £32	105
Sloan Electric Co.	33		

Robert Edwin Walker, Eign Road, and 16, Widemarsh Street, Hereford, electrical engineer, &c.—This debtor attended at the Shirehall, Hereford, on Tuesday last week, for his adjourned public examination before Mr. Registrar W. T. Carless. The liabilities amounted to £200, with assets £181, the deficiency being £19.

W. S. Jenkinson, electrical engineer, Rodborough, near Stroud, Gloucestershire.—Receiving order made February 23rd, on debtor's petition.

W. G. Everingham, electrician, Ilford.—At Chelmsford, on February 24th, a receiving order was made on debtor's own petition.

Alan McAlpin (McAlpin & Co.), electrical engineer, Leicester.—A receiving order was made on February 24th on debtor's own petition. First meeting, March 10th; public examination, March 11th, both at Leicester.

Dissolution.—Messrs. C. D. Copland and E. Cardin (Peers Copland & Cardin, consulting electrical engineers, 16, John Dalton Street, Manchester, and Copland & Cardin, Newport, Mon.), have dissolved partnership. Mr. Copland will attend to debts and continue the business as "C. D. Copland."

Canada.—H.M. Trade Commissioner, 120, Board of Trade Buildings, Montreal, states that a company at Vancouver, British Columbia, is desirous of obtaining the representation of a British firm making a line of electrical specialities.

Book Notices.—*Arbeiten aus dem Elektrotechnischen Institut, Karlsruhe.* Edited by Dr. E. Arnold. 310 pp., and 260 illustrations. Berlin: Julius Springer. Price M. 10.—This is a collection of seven distinct investigations carried out recently at Karlsruhe, under the direction of Dr. Arnold. Six of them deal with various branches of the commutation question, viz. (1) an experimental investigation of commutation in direct-current machinery, by Dr. Arnold; (2) dynamo brush friction, by Dr. J. Liska; (3) experiments on single-phase series commutator motors, with special reference to the use of commutating poles, by Dr. E. Jonar; (4) magnetic leakage from commutating poles, by Dr. F. Schmivigh; (5) the effect on commutation of variations in the brush contact resistance, and in the loss distribution over the brush contact, by Dr. F. Jordan; and (6) the connection between brush contact resistance and temperature, by Dr. Arnold and Dr. Pfiffner. The seventh article is by Dr. Fraenckel on the compensated single-phase shunt motor of Arnold and La Cour, and although not confined to the question of commutation, deals with this matter amongst others. The whole forms another testimony to the useful work that is being done at Karlsruhe, and is distinguished throughout by the thorough and detailed treatment which Dr. Arnold's name attached to a book has led one to expect. Those interested in any phase of the commutation problem in connection with either direct or alternating-current machines cannot afford to leave the book unread.

The Commercial Cable Co. (Mackay Companies' System) have issued a booklet commemorative of the "silver anniversary" of the company, which, from two Atlantic cables in 1884, has developed a system of cables and landlines extending round two-thirds of the earth's circumference, from Europe to China. The booklet contains a sketch of the history of the company, which was incorporated by J. W. Mackay and J. G. Bennett in 1883, and gives particulars of the company's cables, lines and services, with many illustrations of offices, cable stations, &c., in Europe, America and other parts, together with maps showing the connections of the system all over the world.

"Das Elektrische Bogenlicht." By Ewald Rasch. 1910. Brunswick: Friedr. Vieweg & Sohn. Price M. 6.

"Electric Power Plant Engineering." By J. Weingreen. 1910. London: Hill Publishing Co., Ltd. Price 21s. net.

"India-Rubber and Gutta-Percha." Translated from the French of T. Seeligman, G. Lamy Torrilhon and H. Falconnet. By John Geddes McIntosh. London: Scott, Greenwood & Son. 1910. Price 12s. 6d. net.

Austria.—New works for the manufacture of accumulators are about to be established at Tetschen by Messrs. Alfred Luscher & Co., accumulator manufacturers, of Dresden.

Motor-cars for Calcutta.—The Vulcan Motor and Engineering Co., of Southport, have just supplied four of their 12-h.p. motor-cars to the Calcutta Electric Supply Corporation, through Messrs. Crompton & Co., Ltd.

Catalogues and Lists.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London, E.C.—Two new pamphlets—one giving particulars and prices of their "London" and "Henley" tapes; the other giving a sectional illustration of their extra-high-tension cables (130,000 volts, described in the Review about a couple of months ago), manufactured for the Marconi Wireless Telegraph Co., Ltd., for use at their Clifden and Glace Bay stations.

British Insulated and Helsby Cables, Ltd., Prescot, Lancs.—Leaflet L38, illustrating, describing and pricing their wall pattern telephone switchboards T41 to T46, also their magneto mining telephones.

Messrs. Thomas L. Scott & Co., Ltd., 28, Martin's Lane, Cannon Street, London, E.C.—Twenty-eight page catalogue, containing full information regarding the Conta flame arc lamps, which are self-regulating without clockwork, and suitable for any supply and voltage, and for either flame or pure carbons. The lamps can be converted from continuous to alternating current and *vice versâ*, the same carbons serving without alteration. Prices, code words, dimensions, directions for working and particulars of interchangeable parts and accessories, are all given.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.—List containing a description, with illustrations of their type No. 27 cinematograph resistances, and tabulated prices and particulars of five-section frames for one arc taking up to 50 amperes.

Messrs. Pritchetts & Gold are circulating a hanging white showcard bearing the words "Pritchetts & Gold Accumulators," and an effective representation of their cell, all boldly printed in black. Copies will be sent to anyone interested, on application to them at 58, Victoria Street, S.W.

Messrs. C. E. Lugard & Co., Chester.—Booklet No. 2, describing the firm's S.M. magnetic drive for planing machines, in which a double magnetic clutch takes the place of the usual pulley arrangement with striking gear; the movement of the table operates a switch, which energises the clutches, alternately coupling up the "cutting" and "return" motions. The arrangement provides a comparatively inexpensive method of bringing an old planing machine up to date and increasing its output and efficiency.

The Liverpool Electric Cable Co., Ltd., Liverpool.—Catalogue describing and illustrating the Liverpool "Multicore" ignition cable (Simplex patent) for use on motor-cars, aeroplanes, airships, &c. The various wires between the distributors and sparking plugs are moulded together into a solid ebonite cable, connections being made by short flexible leads from brass connectors to the distributor or magneto, while small insulated switches connect from the cable on to the sparking plugs direct. The system is mechanically sound, and its reliability on the road has been proved during two years' trial.

Messrs. Richard Pape, Ltd., Albion House, New Oxford Street, W.C.—The "Fors" catalogue for 1910, describing, pricing and illustrating the "Fors" accumulator, for ignition, lighting, scientific work, &c., also the "Fors" hand lamp and the "Eley-Fors" miners' safety lamp. This accumulator has been described in our pages; it may be remembered that one feature is the separation of the positive and negative elements by a porous pot. Reduced weight, elimination of internal short-circuiting and retention of charge when not in use, are advantages claimed for this cell.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—Thirty-two-page finely-produced catalogue of prepayment meters. The prepayment mechanism is fully described, excellent lettered half-tones being given to show the various detailed parts. The switch mechanism and coin box are particularised, information and drawings indicate dimensions and weights, and diagrams of connections are included. Four full-page half-tone views at the end show a corner of the firm's testing department, the test bench, the machine and first assembling shop, and the train-making and second assembling shop.

Newall Engineering Co., Blackhorse Lane, Walthamstow, E.—In view of the considerable increase in the use of the metric system experienced by the company, it has published its standard tables of limits for diameters up to 150 mm. in metric sizes on a card, which can be obtained free on application to the company.

Messrs. Andre Citroen, 19-21, Queen Victoria Street, E.C.—Pamphlet, entitled "Citroën gear at Work," consisting entirely of a number of clear half-tones of their machine-cut helical gears practically applied in mining, crane, pumping, machine tool, rolling mill, spinning mill, turbine drive and other work. An accompanying leaflet discusses the evolution of double helical gears, and sets forth the advantages of the Citroën gears.

Foster Arc Lamp and Engineering Co., Wimbledon, S.W.—Leaflet and price list of "Foster" metal-filament lamps, wholly British made, for voltages from 25 to 260.

Annual Dinners.—The annual dinner of the employés of Messrs. Laurence, Scott & Co., Ltd., was held in Norwich on February 18th, this being the twenty-first annual gathering of the kind, and the first since the "coming of age" of the company last year. In the unavoidable absence of Mr. Laurence the chair was taken by Mr. Cecil Wilson, supported by Messrs. W. H. Scott and W. B. Sisling. Those attending were the guests of the directors, who, in honour of the occasion, took upon themselves the evening's entertainment. After the loyal toast, "Success to the Firm" was proposed, and Mr. Wilson, in responding, traced the continued progress of the company since its registration in 1888. In spite of the general depression of trade, and in particular the decreased shipbuilding output of the past year, they had felt themselves justified in putting in hand another considerable extension to the works, which was now nearing completion, and would, he hoped, soon be full of work. To meet the keen and increasing competition experienced in the engineering trades, the company relied to a large extent on a continuance of the hearty co-operation between employers and men that had given such good results in the past. He referred to the success of the various athletic clubs and the social organisations got up among the employés at Gothic Works, and said that these had the hearty support of the directors. He concluded with a reference to the pensions fund and to the sick club and insurance schemes in connection with the works. Mr. Scott, in proposing "The Staff," also spoke of the good feeling existing between all sections at the works, and said that this was a most important factor in the cheap production of high-class work. He referred to the unemployment so generally prevalent in the country, and said that the question was one to which the directors gave the most anxious consideration, as, he believed, did most large employers of labour. Mr. Sisling proposed "The Visitors," and said that this was the first time they had been able to welcome the representatives of their auditors to a works dinner. Mr. Fenwick (Messrs. W. B. Peat), in reply, said it was a real pleasure to come down to Gothic Works, where he found books kept with such perfect system. He was sure it must give the employés of the company a welcome sense of confidence to know that they had such excellent business management. The toast list was interspersed with an enjoyable programme of song and sketch. The arrangements for the evening were in the hands of a committee of the workmen.

Sweden.—The Swedish Water-Power Union, of Stockholm (5 Sturegatan), has recently published a limited edition of a map, in three sheets, showing all the principal waterfalls in Sweden.

China.—In one of our recent articles dealing with the possibilities of doing trade in China, we alluded to the liking of the Chinese for pictorial posters in attractive colours. An American Consul, after visiting the country, urges the importance of pictorial advertising as a means of promoting American trade in China. He refers to the Chinese veneration for pictures and for foreign art.

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"The people have an especial fascination for calendars, and they never throw away a well-illustrated one, but always keep it in a prominent place." On calendars for advertising in China the tastes and prejudices of the people must be remembered. The dog should not appear, he being a street scavenger in China, not a family pet as in England. Here is a point for Mr. Hassall! It is remarked that the "Japanese appear to be imitating American methods of advertising by big posters, big signs which can be read from railroad trains, and electrical illuminations at night. Ladies dressed in the costumes of the Far East, flowers, mountain scenery, "and other things considered beautiful" are used for subjects in these pictorial advertisements.

Fire.—We understand that the reports appearing in the daily Press of the fire which occurred at the works of Messrs. Johnson & Phillips, Ltd., Old Charlton, Kent, on Tuesday night, are ridiculously exaggerated. The damage done was confined to one floor of a two-storied building in the cable works. This floor has been used for small wire-braiding operations, giving employment to only some 20 or 30 girls. The fire will have practically no effect upon the general course of business, and contracts for larger cables will not be delayed in the least.

Trade Announcements.—Messrs. Electrical Installations, Ltd., of Bassishaw House, Basinghall Street, E.C., inform us that owing to increasing business, they are removing to larger premises, on March 25th, at 27, Martin's Lane, Cannon Street, E.C.

Increased business in tantalum lamps and fittings has made it necessary for Siemens Bros. Dynamo Works, Ltd., of Dalston, to install an additional telephone line. They have now four lines, as follow:—8,387, 8,388 and 8,389 "Central," and "Dalston" 4.

The Stern Sonneborn Oil Co., Ltd., of Royal London House, Finsbury Square, E.C., notify that their consulting and expert chemist, Dr. Oberlander, has been studying the question of transformer oils to fill electrical engineers' requirements in regard to high flash points, puncture tests, &c., for the past three years, and as the result of his electrical and chemical tests they are now introducing an oil specially suitable for such service.

Mr. E. B. Mulliner, late of the Liverpool Corporation, and consulting engineer, having recently joined the firm of Lind & Co., Ltd., 37, Moorfields, Liverpool, invited the directors and staff to dinner at the Bradford Hotel, Liverpool, on February 18th. After the loyal toast, Mr. Lind, chairman and founder of the firm, proposed the health of the staff and prosperity of the firm. Mr. Hall, the chief storekeeper, replied on behalf of the staff. Mr. Wood, in proposing the health of the host, stated that he welcomed Mr. Mulliner to the firm not only because he was able to bring a large experience of engineering practice to assist the company, but also because he had many other qualifications that would be of benefit. Mr. Mulliner replied, and said that he hoped that this function would become an annual one.

Messrs. Marryat & Place, of 28, Hatton Garden, E.C., have appointed Messrs. Marshall Osborne & Co., of 55, Newhall Street, Birmingham, as agents for the sale of their automatic lifts in the Midland district.

The Deutsche Beck-Bogenlampen G.m.b.H., Frankfort, announces that, as from February 1st, it has taken over the works and business of the Carbone-Licht G.m.b.H., of Berlin-Weissensee, which is now constituted as the "Carbonelicht" department of the former.

Russian Electric Railway Exhibition. — With reference to the exhibition demonstrating the application of electricity to railways which is to be held at St. Petersburg, H.M. Commercial Attaché at that city (Mr. H. Cooke) now reports (says the *Board of Trade Journal*) that the exhibition will open on August 14th/27th and will remain open for two or three months. It will be divided into the following sections:—(1) The application of electricity to the working of steam railways; (2) the application of electrical energy to train traction on (*a*) main railway lines, (*b*) local railways, (*c*) tramways; (3) the application of natural water power. An expert Commission will report to the Russian Government concerning such exhibits as are most prominent from their utility, as also such as most fully correspond with the aims of the exhibition. Awards must be confirmed by the Minister of Commerce. Special importance is attached to the exhibiting of anything new in connection with electric traction, especially battery cars, mono-rail lines, &c. For further information, application may be made to the President of the Organising Committee of the Exhibition, Mr. N. A. Sitenko, 24, Sadovaia, St. Petersburg.

For Sale. — Chester.—The Corporation Electricity Department is offering a complete three-wire switchboard for sale.

Mr. C. D. Phillips, jun., of Cardiff, is offering for sale by tender, under instructions from the Radyr Electric Co., Ltd., certain electric lighting plant, including suction gas engine, dynamo, storage battery, switchboard, &c. A firm is advertising steam and electrical plant, battery, &c., for sale. See our advertisement pages for particulars.

LIGHTING and POWER NOTES.

Asiatic Turkey.—The municipal authorities of Brussia are considering the question of the establishment of a central electric lighting station and an electric tramway in the town.

Bedford.—The T.C. has decided to extend the H.T. cables to the new factory being built by Messrs. C. & R. Light, Ltd., at an estimated cost of £1,080, with switch-gear, &c., and to construct a sub-station at an outlay of £220. The firm undertakes to pay a minimum of £770 per annum for five years for energy.

Blackpool.—The Finance Committee of the T.C. has recommended the T.C. to apply to the L.G.B. for a loan of £6,000 for cable extensions.

Brighton.—At yesterday's meeting of the T.C., the scheme for wiring consumers' premises for electric lighting was to come up again for discussion.

British Columbia.—Details are to hand of the power plant which is to be installed at Jordan river station in connection with the British Columbia Electric Railway Co.'s scheme. The plant when completed will have a capacity of four 4,000-kw. units, and the first unit is being supplied by the John Macdougall Ironworks Co., Ltd. It will be installed by October 1st next, and will consist of a 10,000-h.p. Doble impulse water wheel directly connected to a 4,000 kw. Allis-Chalmers-Bullock generator running at 400 r.p.m. The water taken from the Jordan River, on the west coast of Vancouver Island, has a head of 1,180 ft.

British East Africa.—Some details are to hand concerning the Nairobi Electric Power and Lighting Co.'s plant, of which the manager is Mr. Chas. Udall. Water is obtained from the River Reivera, across which a concrete dam has been placed; the water is conveyed by wooden fluming, and three 36-in. steel pipes to turbines flexibly coupled to E.C.C. 10,000-volt 50-cycle three-phase alternators, and the energy is transmitted at this pressure over aerial copper lines, a distance of 14 miles, and stepped down to 2,500 volts, for distribution in the town. This distribution is also by overhead wires, and a further reduction in pressure, to 200 volts, is made for power and lighting in the centre of the town. The present load is equivalent to 6,000 8-c.p. lamps and 70 b.h.p. of motors (in flour mills, an ice factory, two soda-water factories, and sundry other works); the plant capacity is 450 kw.

Continental Note.—Holland.—Application has been made by a resident of Amsterdam, acting on behalf of a German company, for a concession for a large electric power station between Hilversum and Bussum, to supply light and power to all the towns and villages of the Gooi district.—*Board of Trade Journal.*

Ealing.—The Metropolitan Asylums Board on February 25th decided to obtain a supply of electricity from the B.C. for the centrifugal pump and electric motor for the tower at Ealing reservoir.

Falkirk.—The T.C. has agreed to extend the electric plant at a cost of £12,000, chiefly to supply energy for power to works. The motion met with considerable opposition, there being a feeling that rather than involve the town in the expense proposed, it would be better to allow the Scottish Central Power Co., whose works are on the outskirts of the burgh, to come into the town and supply power. The company had made an offer to supply current at a flat rate of ½d. per unit delivered at the works for a period of 20 years, with an annual minimum supply of £1,200 worth. Several of the Councillors favoured a proposal to dismantle the municipal works and allow a private company to assume control of the supply. The motion, however, was carried by 8 votes to 4.

Haslingden.—The Town Council on February 24th considered a recommendation from the Electricity Committee to put into force the Electric Lighting Order, 1899. This was characterised as a most serious proposal, as there were only about 80 or 100 probable consumers, and one Councillor feared the loss on the undertaking would be anywhere between £300 and £800 per year. Alderman Barlow, chairman of the Committee, defended the recommendation. The matter was then taken by the Council in committee, where a further consideration of it was adjourned.

Heston and Isleworth.—The estimates of the Electricity Committee for the ensuing financial year include £4,250 capital expenditure, of which £3,750 is for new buildings and machinery. At the last meeting of the Council, the chairman of the Committee explained that the engineer was to prepare plans to provide for 250 kw. extra in readiness for the next winter season. The existing capacity is 500 kw., and the highest demand during the winter was 405. In reply to a suggestion that the public lighting should be reduced so as to obviate the necessity of installing new plant, the chairman of the Committee said that the whole of the public lighting only represented 60 kw.

Londonderry.—The report of Mr. Macrory, the engineer, recommending extensions of the electricity undertaking, was adopted at a recent meeting of the T.C.

London.—Bermondsey.—The Electricity Committee has had under consideration the present method of arranging terms with special consumers; it does not regard it as a businesslike mode of procedure to come to the Council and report what it desires to do, having regard to the fact that it has three strong competitors (the two electric lighting companies and the gas company) ready to take advantage of the publicity given to negotiations about to be undertaken by the Committee. It has, therefore, been decided that the Committee is to have power to make special terms with large consumers, subject to each name being reported

to the Council, and a book laid upon the table at each meeting of the Council giving full particulars of the terms granted.

FULHAM.—Application is to be made to the L.C.C. for sanction to borrow £6,880, made up as follows:—Mains extensions, including transformers, switchgear and sub-stations, £2,880; 500 electricity meters, £1,000; 500 house connections, £3,000.

MARYLEBONE.—At the fortnightly meeting of the B.C., a good deal of discussion took place on the recommendation of the Baths and Washhouses Committee to accept the offer of the electricity department to overhaul and rewire the baths installation at £400. Several speakers contended that the operations of the sales department were unfair to the local contractors, and that the work should be put to public tender. For the electricity department it was contended that the price was a generous one, and the work of a peculiar character; ultimately an amendment that the Committee be instructed to invite tenders for the execution of the work, was carried by 27 votes to 18.

HAMPSTEAD.—At the meeting of the Council on February 24th, it was agreed to substitute Oliver magazine flame arc lamps in Finchley Road for the arc lamps at present in use, and to extend the arc lighting of that road to Platt's Lane; 159 street gas lamps in Cricklewood, Kilburn and West End districts are to be converted to electricity, each lantern to be fitted with two 35-watt metallic-filament lamps. This, it was explained, is the first step towards the conversion of the whole 2,237 street gas lamps in the borough to electric incandescent metal-filament lighting. The Electricity Committee reports that this will bring about an immediate saving of £587 per annum, and a saving of £2,749 per annum after the end of eight years.

Hull.—Considerable discussion ensued at the last meeting of the Electric Light Committee on the question of the discount allowed to the users of electricity for power. Mr. Costello contended that users of electricity for lighting purposes should be allowed the same terms in regard to discount as the users of electricity for motor purposes. The engineer (Mr. Bell) pointed out that what was being done in Hull was being done in practically every town in England. The lighting accounts were collected quarterly, and those of the motor users monthly, and in the case of the latter there was a small discount allowed of 2½ per cent. if the accounts were paid within 14 days. They could not give the same discount to lighting consumers, because they did not pay monthly. The chairman (Ald. Hanger) also pointed out that the income from lighting had gone down for three or four years successively. This was owing to the economy of the new metallic lamp. No alteration was agreed to, but the matter is not to be allowed to drop.

Maidstone.—The Hollingbourne R.D.C. has given permission for the T.C. to supply electricity to Turkey Mills, a portion of which is in the area of the R.D.C.

Manchuria.—American Consular reports state that the Mukden electric light plant was installed by the Chinese local Government in connection with the Government's provincial mint on October 1st, 1909. According to the original plans the plant was to have been of only 5,000 lamps capacity. Recently, however, the management decided to enlarge the plant to 15,000 lamps, and has already placed orders for the additional machinery and materials. The total cost of the plant when completed will be appproximately $165,000 American currency, of which amount an American firm will supply about $115,000 worth of materials and machinery. The entire installation has been under the supervision of an American engineer employed by the Chinese Government. The plant is affording a most satisfactory service and, for this part of the world, at very reasonable rates. The popularity of electricity among the Chinese as a means of lighting has again been fully demonstrated by the eagerness with which the inhabitants of Mukden are clamouring for lights.

The following is a schedule of the new concern's lighting rates—flat-rate system—per month: Carbon-filament lamps—8-C.P., 54 cents; 16-C.P., 90 cents. Metallic-filament lamps—20-C.P., 90 cents; 30-C.P., $1.34; 50-C.P., $1.80; 80-C.P., $2.24. Lamps will be paid for and owned by the customers. Wiring and pendant fittings will be installed for 23 cents each.

Meter-rate system: Per unit, 11 cents; meter rental, on bills less than $9, 45 cents per month. Ten lamps or more will be required for each meter. Wiring and fittings will be installed at cost price, and the material will be the property of the customers. The installation cost per pendant lamp will be from $1.35 to $2.25 each, varying as the distance between lamps increases and the number of lamps decreases.

Discount on bills per month: 5 per cent. during the first five days of succeeding months; 5 per cent. on all bills over $22; 10 per cent. on all bills over $45; 15 per cent. on all bills over $67.

Monaghan.—A public meeting was held on February 25th to take into consideration the lighting of the town by electricity. Mr. Francis Tierney, J.P., chairman of the Urban Council, presided, and explained the object of the meeting. Mr. Francis Duffy said that they had been paying enormous bills to the local gas company; they paid the company £140 a year. Mr. Robert Harrison, manager of the gas works, said that was not so. Mr. Boylan, town clerk, said that the last three bills amounted to £141 for three quarters. Mr. Pegg, of the firm of Miller, Wilson and Pegg, Belfast, said that the actual cost of providing an electrical installation at Monaghan would be £3,750. They might want a little more if the gas company fought the matter, which drew from Mr. Harrison the assurance that they would. A resolution in favour of electric lighting was declared carried.

Morecambe.—Application has been made by the manager of the Morecambe Tower and Casino for electric current, and the Corporation has agreed to supply at the rate of 3d. per unit for power, and 5d. for lighting, if not less than 10,000 units are consumed.

Salford.—On and after April 1st, users of electricity for power purposes are to be allowed to use current for lighting purposes only up to 10 per cent. of their power consumption, instead of 15 per cent. as at present. An application of the Manchester Ship Canal Co. has been granted for permission to use current supplied under their agreement, for working portable electrical controllers, for controlling the operation of six hydraulic cranes to be used during the timber season from March to October.

Shildon.—The U.D.C. has decided to confer with the Northern Counties Electricity Supply Co., with the object of securing a reduction in the price of electricity. In a letter to the Council, the company states that under the existing agreement, it is under the unreasonable obligation not to obtain a supply of energy from another source. The agreement and the obligations practically amounted to a restraint on trade, and such serious losses have been incurred under it, that the directors might have to consider an application to the Board of Trade for a revocation of the prov. order, and the subsequent abandonment of the works. The company added that it thought it could make some suggestions which would enable it to reduce the prices, and which would at the same time make no difference to the financial results of the business between the Council and company.

Ship Lighting Installation.—The electrical installation on the new Cunarder *Franconia*, comprising some 3,000 lights, also bells, telephones, clocks, radiators, motors, fans, &c., driven from three 130-KW. generating sets, is to be supplied by Messrs. W. C. Martin & Co., of Glasgow, who, it will be remembered, carried out the installation on the *Mauretania*, described in our pages.

Southampton.—The T.C. has applied for a loan of £3,000 for mains and service extensions.

Walthamstow.—Application is to be made to the L.G.B. for sanction to borrow £1,210, made up as follows:—Booster set and connecting cables, £760; switchboard and instruments, £265; extension to existing switchboard and gallery, £125; contingencies, £60.

Wokingham.—At a special meeting of the T.C. recently, the General Purposes Committee recommended that steps be taken to apply for a prov. order to authorise the Council to generate and distribute electricity in the borough, and to include any possible extended area of the borough. A further recommendation was presented to the effect that a petition be lodged against the Reading Electric Supply Bill. The recommendations were adopted, and a Sub-Committee was appointed to prepare the necessary scheme for the prov. order.

TRAMWAY and RAILWAY NOTES.

Bolton.—A meeting of ratepayers was held on Wednesday last week to protest against the continued through running of the South Lancashire Co.'s cars between Four Lane Ends and Bolton. Allegations were made of unsatisfactory services on the part of the company's cars.

Blackburn.—A movement was recently set on foot for the formation of an institute for Blackburn electrical tramway employés. Premises have been taken and the institute has been formally opened. It provides a billiard room and social conveniences. There are about 170 employés in the different departments, and 120 have already joined. The idea originated with the tramway manager, Mr. J. H. Cowell.

Canterbury.—It is announced that an application is to be made to the Light Railway Commissioners for an order authorising the construction of a light railway between Canterbury and Herne Bay.

Canada.—An agreement has been arrived at between the Canadian Pacific Railway Co. and the British Columbia Electric Railway Co., in accordance with which not less than 10 miles of car-line will shortly be built in Lulu Island, and there will probably be extensions of much greater length. Further, three trunk lines are to be constructed from the town of Vancouver southward to the north arm of the Fraser River.

An electric railway, 50 miles long, is being considered between Niagara Falls and Dunville. Mr. J. Carlton Gardner, of Niagara Falls, is the consulting engineer.

Carshalton.—In answer to the representations of the U.D.C. on the subject of the "fair-fare" system in operation on the local tramway, the Board of Trade has replied that it declines to intervene in the dispute. Upon the letter being read at the last Council meeting, it was suggested by a member that the public should boycott the line.

Continental Notes.—Bavaria.—The inquiries extending over a number of years regarding the utilisation of the water-powers of the Bavarian Alps have at last reached a definite result. The Bavarian Ministry of Communications, on the basis of the data collected by the Water Department of the Ministry of Public Works, has scheduled the following river systems for the use of the State Railways:—(1) The so-called Lake Walcheren power station, with overflow into Lake Kochel; (2) the Isar, near Wolfsrathausen, between Puppling and Aumühle; (3) the Upper Alz from Lake Chiem to the Laufenauer Weir, near Altenmirk, in association with a high-pressure installation at the future Lower Alz station near Burghausen; (4) the Lech from its source to the Lechbruck Weir, which, however, may probably be utilised for private industrial purposes pending its actual taking over by the Railway Department; (5) the Iller, but its appropriation is dependent upon the result of negotiations pending with Württemberg; (6) the Upper Saalach from the frontier to the future State Saalach station of Kibling-Kirchberg, near Bad Reichenhall; (7) the Inn, between Wasserburg and Mühldorf. The 16 water-courses south of the Donau, with 61 falls, giving some 375,820 H.P., recognised by the Ministry of Communications as worth utilising, are allotted to private industrial users; but the Ministry retain the right, in the event of increased power requirements, to appropriate a portion or take energy from private undertakings. On account of the public criticism to which the first-named supply was subjected, the Bavarian Government two years ago opened an international competition for schemes embracing not only the hydro-technical, but the complete mechanical and electrical installation. In the result, six schemes were premiated, the first prize being awarded to that sent in by the Dyckerhoff & Widmann Co., of Nürnberg, in association with the Maschinenfabrik Augsburg and the Siemens-Schuckertwerke, of Berlin. The details of this scheme are too extensive to reproduce, but it may be remarked that the difference of level between the Walcheren and Kochel Lakes of about 200 metres, and the situation of the River Isar as a connection between the two, favoured both efficiency and economy in the plans submitted. Nevertheless, the cost of this single section of the official scheduled schemes amounted to as much as £1,250,000, yielding 52,400 H.P., or at the rate of 477 marks per H.P. of installation.

Germany.—The scheme for the construction of a diminutive underground electric railway for the transport of parcels and sacks of mails in Berlin has hitherto not been settled in so far as the proposed route is concerned, although it is assumed that the tunnel line will proceed from the Post Office in the Spandauer Strasse to the future large office in the Franzosische Strasse, and thence to the busy post office at the Potsdam Railway Station. In the meantime an experimental line in illustration of the projected system has been laid down at the Siemens-Schuckert works on the Nonnendamm. It has been inspected in operation by many engineers, including two officials of the English Post Office, who were dispatched from London to Berlin for the purpose of examining the technical equipment. The railway, which is 1 ft. 4½ in. in gauge, has a total length of 1,330 ft.; the locomotive is 5 ft. long and 1 ft. 6 in. high, and is able to haul four loaded trucks at a speed of 25 miles an hour.

Italy.—It is announced from Zurich that the Italian Siemens-Schuckert Co., of Milan, and the Impresa Alessi, of Rome, propose that a concession should be granted for the construction of a normal-gauge railway, as an alternative to the Spengel railway scheme, from Tirano to Bormio, and for the continuation of this line through a tunnel 5½ miles long from Bormio Valcava to Mals on the Winschgau railway and the future Mals-Landeck line. The railway project, which is substituted for the former Ortler scheme, would establish an important means of communication between Germany and Genoa.

The Società Elettrica di Campodolcino is promoting a syndicate for the construction of a cable railway, 14 km. long, from Campodolcino to Chiavenna, in the Valley of the Splugo, at an estimated cost of 350,000 lire; 120,000 lire being allotted to the hydro-electric plant and 250,000 lire for the rolling stock, &c.

Austria.—Among new State railway projects is the establishment of an electric railway from Bozen to Rentsch, and thence to Kardaun at the entrance of the Eggental. The power will be supplied by the Etsch station.

Sweden.—The State Railway Administration has suggested to the Government that the latter should ask the present Parliament for a vote of 7,500,000 crowns, so as to enable the establishment of a hydro-electric station at the Vakkokoski waterfall, which is situated between Torne Trask and Kiruna. A further sum of 650,000 crowns is required for the electrical equipment of the station, and 654,000 crowns for the construction of a railway connection between Vakkokoski and Kiruna, whilst an additional amount of 2,804,000 crowns will be needed for the development of the works next year.

Turkey.—Plans are being prepared in respect of a projected electric tramway between the town of Niausta and the station of that name on the Salonica-Monastir Railway.

Hungary.—A concession has been granted by the Hungarian Minister of Trade for the construction either of a cable or a rack electric railway up the Szalok Peak in the Upper Tatra mountains. The line will start from the terminus of the Tatrafured-Tarajka electric cable railway.

Spain.—The "Sociedad Valenciana de Tranvias," Valencia, has obtained powers to introduce electric traction, in place of the present horse traction, on its tramways from Valencia to Burjasot and Godella.

During a violent storm at Alcoy a tree was blown across an electric tramway, falling on and wrecking an electric car, two persons being killed and nine injured.

Glasgow.—At a recent meeting of the T.C., a Mr. Pratt moved that it be remitted to the Tramways Committee to consider and report on the question of an extension of the existing ½d. stages. The proposal was discussed at great length, and ultimately rejected by 34 votes to 20.

Halifax.—The Tramways Committee has under consideration a request by the Soyland U.D.C. for a trackless car service from the tramway terminus at Triangle to Rishworth. The Corporation has no power to carry out the proposal, but it is possible that Parliamentary powers will be obtained. A scheme for the more effective management of the tramways and electricity departments is under consideration.

Heston and Isleworth.—The Middlesex County Council's Light Railways Committee has promised a deputation from the Twickenham, Southall and Heston and Isleworth U.D.C.'s to fully consider proposals for establishing cross-country communication between Southall and Twickenham. The County Committee has been asked to put pressure on the London United Tramways Co. to construct a line over their route under clauses in their Act, that they shall do so if such a line can be shown to be necessitous and profitable, or with the alternative that the County shall construct a local light railway or tramway worked by electricity.

Hull.—The Tramways Committee announces a profit on the past year's working of £20,731, as compared with about £26,000 in the previous 12 months. A suggestion that £18,000 should be contributed to the rates was ultimately modified, so that £16,000 is now to be contributed.

Isle of Wight.—At the recent half-yearly meeting of the Isle of Wight Railway Co., the chairman, in referring to the proposals for electrification, said he feared that the time had hardly yet arrived when any feasible scheme could be taken in hand.

At the meeting of the Isle of Wight Central Railway, also, reference was made to the subject of electrification. It was stated that no definite scheme had been proposed, and that no line in the kingdom dealing with a mixed traffic has as yet been electrified.

Japan.—H.M. Commercial Attaché at Yokohama (Mr. E. F. Crowe) reports that several works of improvement are being considered by the Railway Board. These include:—

The quadrupling of the Yokohama-Tokio line, and the addition of electric traction to the present system of steam traction, Mr. Crowe is given to understand that it is proposed to lay an electric tramway track of standard gauge along the present railway line; power would be supplied from the Rokugo River.

The electrifying of the Usui section.

Increasing the speed on the Kobe-Kioto section. Some trial runs have been made, but, as considerable changes will be required, no definite decision had yet (December 9th) been arrived at.

Building a large central station at Tokio, and linking up the railway with the harbour works at Osaka and Yokohama.—*Board of Trade Journal.*

London.—It is reported that the Metropolitan District Railway will shortly order new rolling stock from British firms. These will include 32 motor and 20 trailer cars built entirely of steel, and with B.T.-H. motor equipments.

Middlesex.—Reporting on the three years' work of the Middlesex C.C. light railways, Alderman Regester, the Chairman of the Council, stated that the total length of light railway authorised by orders was 43 miles 1 furlong 2·47 chains, and the length constructed was 38 miles 7 furlongs 6·35 chains. By the construction of a link connecting at Acton with the London United Tramways system, it was possible to travel by car from the extreme south and west to the north of the county. The expenditure on the system to March 31st last was £1,518,197, and the approximate expenditure to the end of December was £1,607,467. The lines were leased to a company, who had paid, since 1904, interest as rent, £103,686, and as share of profits, £6,425, a total of £110,110. For the year ending December, 1908, nothing was paid as profits, but £46,772 came in under the first head.

The Middlesex C.C. is reported to be considering the advisability of running low open cars on the county tramways during the summer months.

North-Eastern Railway.—The last half-yearly report of this company shows that for the six months ending December 31st, 1909, 1,952,154 electric (passenger) car-miles, and 2,697 electric (goods) train-miles were worked, both figures representing an increase over those for the corresponding period in 1908. The cost of working amounted to, wages £3,857, and energy (purchased) £13,365.

Southampton.—The Tramways Committee has adopted a report from the manager with regard to equipping bogie cars. He recommends equal wheel trucks with four small motors of the same type as those now in use. He is further of opinion that it is advisable to deal with Messrs. Heenan & Froude, as they are nearer than other firms to Southampton, and have a high reputation for good work. The estimate of the cost of the extension of the tramways to Northam is, track, £8,428; loop, £400; overhead equipment, £920; extension of car-sheds, £5,000; and sundries, making a total of £15,248.

Sunderland.—At a meeting of the Tramways Committee of the T.C. on February 24th, the estimate for the year ending March 31st, 1910, was submitted. This shows a net profit of

£2,574, which will be placed to the reserve and renewals fund. Owing to trade depression there was a falling-off in the income, the total being £59,173, against the actual income of £61,323 for 1909. The total expenditure is put down at £37,431, compared with an actual expenditure of £38,851 for the preceding year. The cost of energy is estimated at £10,766, against £12,432 for last year. This is due to the reduction in the charge, and to the introduction of meters, which, up to the end of September, had resulted in a saving of £700. Mr. George New, the chairman, made a statement as to the financial position of the undertaking. He said that the total expenditure was £299 524; the total carried to depreciation reserve, compensation reserve, &c., was £133,809, equal to 45 per cent. on the capital cost. The total amount carried to the rates was £30,027, over 10 per cent. on the capital cost, the present debt was £208,420, and the amount invested and in hand for renewals and compensation fund was £28,000, about 13 per cent. on the outstanding debt.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted.—Perim-Obock, February 22nd; Paramaribo-Cayenne, February 26th.

Cheaper Press Telegrams.—The Indian Government has agreed to the reduction of the rate of Press telegrams between Great Britain and Penang, Singapore and Labuan from 1s. 4d. to 9d. a word.

Glasgow.—It is officially announced that the P.M.G. has taken steps towards the unification of the Post Office and National Telephone Co.'s systems in Glasgow. A new P.O. exchange will shortly be opened in the Central District, equipped for 10,000 subscribers, and two other large exchanges are being constructed, one by the Post Office and the other by the company, which will take the place of four existing exchanges. Most of the overhead lines in the central district will be replaced by underground cables, and in other districts the subscribers of the two systems will be similarly concentrated in fewer exchanges. Arrangements have also been made for the prevention of overlapping, and of loss of employment on the part of the canvassing staff.

Mackay Companies.—It is announced that the "Mackay Companies" has sold its entire holdings of stock in the American Telephone and Telegraph Co.

New Cable.—The Commercial Cable Co. has decided to lay an additional Atlantic cable—the sixth belonging to this company. An additional cable will also be laid between Weston-super-Mare and Waterville (Co. Kerry).

Pacific Cable.—The High Commissioner for Australia, Sir George Reid, has been appointed to fill the vacancy in the Commonwealth representation on the Pacific Cable Board.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—March 14th. Electrical goods for a year to the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman Offices, near Aberdare.

Accrington.—March 12th. Stores and uniform clothing for the Electrical Tramways Committee during the 12 months ending March 31st, 1911.

Australia.—Telephone switchboards for New South Wales, and poles (iron or steel) for Western Australia, for the P.M.G. See "Official Notices" February 4th.

Wire testing machine, for the P.M.G.'s department in Western Australia. See "Official Notices" February 4th.

One electrically-driven dust extractor for the P.M.G.'s Department in Queensland. See "Official Notices" February 11th.

TASMANIA.—Material for accumulator equipment, for the P.M.G. Forms of tender, &c., from the Commonwealth Office, London.

Barrow-in-Furness.—March 7th. Electrical stores for a year, for the T.C. Borough Electrical Engineer.

Belfast.—March 9th. Arc lamps, masts and base columns, for the Harbour Commissioners. See "Official Notices" February 25th.

Birmingham.—March 8th. Electrical accessories for a year, for the Birmingham, Tame and Rea District Drainage Board. J. D. Watson, engineer to the Board, Tyborn, near Birmingham.

Bootle.—The Corporation invites tenders for automatic reversible traction booster, circulating pump and electric motor, automatic reverse-current breakers and traction feeder breakers, shunt-regulating resistances and switches, and re-winding 75-KW. generator armatures. Particulars from the Borough Electrical Engineer.

Brighton.—March 7th. The Lighting Committee is inviting tenders for the purchase of two second-hand Willans engines and two second-hand Crompton generators. See "Official Notices" February 25th.

Bristol.—March 8th. Stores for the Corporation. See "Official Notices" February 18th.

Buenos Ayres.—The *Review of the River Plate* states that the Government will shortly call for tenders for the supply of 20 electric cranes, lifting capacity 1 ton, for the warehouses on the East side of Docks 1 and 2, Port of Buenos Ayres.

Carlisle.—March 14th. Two water-tube boilers, superheaters, mechanical stokers, &c., and two boiler feed pumps, for the Corporation. See "Official Notices" February 25th.

Croydon.—March 14th. Electrical appliances for the B.G. Union Offices, Mayday Road, Thornton Heath.

Dover.—March 8th. Electrical sundries and cables, for a year, for the Harbour Board. M. Mowll, Registrar, Castle Street, Dover. (Deposit 2s. 6d.)

Edmonton.—March 9th. Electrical requirements for the B.G. F. Shelton, clerk, White Hart Lane, Tottenham.

Felixstowe and Walton.—Steel boiler drum, oil cart and set of switchgear and cable connections, for the U.D.C. See "Official Notices" to-day.

Germany.—The municipal authorities of Ulm are about to invite tenders for the establishment of a central electric lighting station in the town, at an estimated cost of £25,000.

Glasgow.—March 22nd. 20,000 car lamps, for the Corporation. See "Official Notices" to-day.

Grimsby.—March 21st. 300 cast-iron lamp-posts, swan necks and D.P. fuse boxes, for the Corporation. See "Official Notices" to-day.

Holland.—March 21st. La Direction de la Monnaie de l'Etat, at Utrecht, is inviting tenders for an installation of electric lighting and power transmission in the Dutch Mint in that town.

Huddersfield.—March 9th. E.L. installation, new school at Birkby, for the T.C. (deposit £2 2s). K. F. Campbell, Borough Engineer, 1, Peel Street.

Keighley.—March 14th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. G. E. Spencer, clerk, North Street, Keighley.

Kingston-upon-Hull.—March 10th. Telephone instruments for the Council. See "Official Notices" February 18th.

London.—BATTERSEA.—Stores for a year, for the B.C. See "Official Notices" February 18th.

L.C.C.—The Highways Committee will shortly invite tenders for 82 meters for recording the energy used at each of the tramway depôts, &c. The estimated cost is £600, including cost of erection and connections. The Department will erect the meters by direct employment of labour.

March 23rd.—Wiring and fittings for the electric lighting at the Camden Street Central School. See "Official Notices" to-day.

Manchester.—March 8th. E.L. and telegraph materials, for a year, for the Great Central Railway Co. W. Williams, Stores Superintendent, Gorton, Manchester.

Newport (Mon.).—March 8th. E.L. fittings for the Board of Guardians. I. Thomas, clerk, Queen's Hill.

Norway.—March 12th. The authorities of the Superior Technical School at Drontheim are inviting tenders for the three electric passenger lifts.

Pontypridd.—March 7th. Electric lamps, stores, paper, rubber, insulated wires and cables, for a year, for the U.D.C. J. E. Teasdel, electrical engineer, Treforest generating station.

Roumania.—March 15th. The Roumanian State Railway authorities in Bucharest are inviting tenders until March 15th for the supply of 4,900 metres of insulated cable.

Spain.—March 18th. The working of the urban telephone system of Vitoria, (the present lease expires on March 14th) for 15 years. Deposit £80. Local representation. Tenders to Direccion General de Correos y Telégrafos, Madrid.

March 26th.—Tenders are being invited by the municipal authorities of Fuentesauco (Province of Zamora) for the concession for the electric lighting of the town during a period of 20 years.

Teneriffe.—March 21st. The municipal authorities of La Luguna, Teneriffe, are inviting tenders for the concession for the public electric lighting of the town until 1954.

Warrington.—March 22nd. 1,000-KW. turbo-alternator, 750-KW. rotary converter and switchgear, for the Corporation. See "Official Notices" to-day.

Wrexham.—March 15th. Stores for the T.C. See "Official Notices" February 18th.

CLOSED.

Ashton-under-Lyne.—The following tenders for plant for the Corporation electricity works are recommended for acceptance:—

Condensing plant.—W. H. Allen, Son & Co., Ltd.
Cooling tower.—The Blasberg Engineering Co., Ltd.
Turbine and generator.—Willans & Robinson, Ltd., with Bruce Peebles, Ltd., electrical plant.
Electric balancer.—The Phœnix Dynamo Manufacturing Co., Ltd.

Australia.—It is announced from Melbourne that the Victoria Government Railways have accepted the tender of the Lorain Steel Co., of America, for fish-plates and steel rails, at £100,000.

British Columbia.—According to the *Canadian Engineer*, Mr. H. W. Kent, the British Columbia representative of the Jens Orten Boving Co., of London, has secured contracts for that firm to supply and erect the 9,000 ft. of pipe lines and specials for conveying the water from the dam to the power house that is required by the Vancouver Island Power Co. for its Jordan River plant on the south-west coast of the island. Estimated cost, £16,000.

Chester.—The Corporation has accepted the tender of the General Electric Co., Ltd., for incandescent lamps required by the electricity department for the next 12 months.

Erith.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. for a switchboard at the electricity station, at £1,083.

Bolton.—The Electricity Committee last week accepted the tender of Messrs. Musgrave & Sons for a boiler.

Bury.—The T.C. has accepted the tender of the United Electric Car Co., Ltd., of Preston, for three tramcar bodies.

Croydon.—The tender of Messrs. W. Cory & Sons, Ltd., was accepted for the supply of coal to the works for the ensuing 12 months, viz.:—Nixon's Navigation, at 24s. 6d. per ton, and Muirfield Washed Peas, at 13s. 2d. per ton, with an option to take slack coal if desired.

Leyton.—The following tenders have been accepted for annual supplies for the electricity undertaking:—C. C. Wakefield and Co., cylinder oil; Oliver Arc Lamp Co., Oliver lamp carbons, £3 13s. 6d. per 1,000 pairs, last year's price, £2 15s.; Standard Cable Co., service line cables.

London.—HOLBORN.—Barlow Bros. have been appointed by the B.C. to carry out electrician's work during the coming year.

ISLINGTON.—The B.C. has accepted the following tenders for annual supplies for the electricity department:—

Meters.—British Westinghouse Co.; Bat Meter Co., Ltd.
Cables.—British Insulated and Helsby Cables, Ltd.
Electrical sundries, lamps, brushes, arc lamp parts, &c.—British Tungsten Lamp Co.; Bryant Trading Syndicate; General Electric Co.; Heap and Johnson; Johnson & Phillips, Ltd.; Falk, Stadelmann & Co.
Cable, terminal service, network boxes and tapes.—Johnson and Phillips, Ltd.; W. Lucy & Co., Ltd.; Eagle Ironworks, Oxford; British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; British Bitumen Co.; General Electric Co., Ltd.
Transformers and accessories.—British Electric Transformer Co.; Ferranti, Ltd.; Sykes & Sugden, Ltd.
Arc lamp carbons and globes.—Sloan Electrical Co.; Geipel & Co.

FULHAM.—The Electricity Committee recommends that a further contract be entered into with Messrs. A. Duckham & Co., Ltd., for cylinder oil for 12 months, at 1s. 7d. per gal., also with Messrs. W. H. Wilcox & Co., Ltd., for engine oil, at 1s. 5d. per gal.

Messrs. Davidson & Co., Ltd., of Belfast, have just received an order for three 65-in. dia. Sirocco (Trade Mark) induced draught fans for the City of London Electric Lighting Co. This is a repeat order, the company having already two Sirocco fans of the same size at work in their station at Bankside.

L.C.C.—The Asylums Committee has accepted tenders from the following for electrical sundries:—General Electric Co., Ltd.; British Electrical and Manufacturing Co., Ltd.; Veritys, Ltd.; Siemens Bros. & Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.; Saxonia Electrical Wire Co., Ltd.; Cox-Walkers, Ltd.; Baxter and Caunter; and Pryke & Palmer. For electric lamps the tenders of the B.T.-H. Co., Ltd., and the Edison & Swan United Electric Light Co. have been accepted.

The Highways Committee received the following tenders for (*a*) 79 sets of window operating gear for bogie cars; and (*b*) 11 sets of similar gear for single truck cars, required in connection with the fitting of roof-covers to 90 double-deck cars:—

	Price per set. (*a*)	(*b*)
Hurst, Nelson & Co., Ltd., (total £668) .. (recommended)	£7 12 6	£6 0 0
Hadley Bros., Birmingham	8 2 0	6 11 0
Player & Mitchell, Birmingham	9 4 4	7 9 9
W. S. Laycock, Ltd., Sheffield	11 2 6	10 2 0
United Electric Car Co., Ltd., Preston	11 5 0	9 15 0
United Brassfounders & Engineers, Ltd., Isaac Storey and Sons, Ltd., Branch, Manchester	11 12 2	9 10 3
Peter Hooker, Ltd., Walthamstow, E.	12 5 0	11 2 6
G. D. Peters & Co., Ltd., Moorfields, E.C.	28 10 0	23 10 0

Estimate of chief officer, £1,125, based upon the prices last paid, viz., £12 10s. per set.

The following tenders were received for the supply of 880 yds. of plough lead cable for electric cars. All prices are less 2½ per cent.

India-Rubber, Gutta-Percha and T. W. Co., Ltd.	(recommended)	£147
St. Helen's Cable & Rubber Co., Ltd.		150
Callender's Cable and Construction Co., Ltd.		155
Johnson & Phillips, Ltd.		155
" " " "	(alternative tender)	159
British Insulated and Helsby Cables, Ltd.		155
" " " "	(alternative tender)	159
W. T. Henley's Telegraph Works Co., Ltd.		155
" " " " "	(alternative tender)	159
" " " " " " "		163
Siemens Bros. & Co., Ltd.		155
Craigpark Electric Cable Co., Ltd		164
W. T. Glover & C., Ltd...		190

Estimate of chief officer, £100.

The tenders received from selected firms for brass fittings required in connection with the fitting of roof covers to 90 double-deck electric cars, were:—

Hurst, Nelson & Co., Ltd.	(recommended)	£187
J. Beresford & Son		193
E. Showell & Sons, Ltd...		195
Howarth & Houson	(less 2½ per cent.)	265
G. D. Peters & Co., Ltd...	" " "	273
Player & Mitchell..	" " "	281
Wm. McGeoch & Co., Ltd.		306
W. S. Laycock, Ltd.	(less 2½ per cent.)	311
Gabriel & Co. (incomplete tender) .. .. " " "		212

Estimate of chief officer, £230.

From the tenders received from selected firms, for the supply of 185 standard door locks, required in fitting roof covers to 90 cars, that of Messrs. F. Mountford, Ltd., Birmingham, at 7s. each (less 2½ per cent.) is recommended.

The Committee recommends the Council to affix its seal to the contract with the British Westinghouse Co. for the supply for the sum of £300 of 500 pressed-brass coil-cases for magnetic brakes.

The Highways Committee received tenders as below for road-work, &c., exclusive of the supply of rails and special trackwork, for electric conduit tramways from Streatham *via* Mitcham Lane and Southcroft Road to Tooting Junction, and in Wimbledon Road:—

	Tramway work.	Paving work.
Kirk & Randall .. .. (recommended)	£35,795	£4,088
Dick, Kerr & Co., Ltd.	36,730	4,427
W. Manders	37,853	4,600
J. Mowlem & Co., Ltd.	33,112	4,411
A. N. Coles	33,659	4,095

Engineer's estimate for tramway work, £37,375; for paving work, £4,577.

WESTMINSTER.—The following is a list of the firms invited to tender, and the amounts of tenders submitted, for the electric lighting and other electrical works at the Westminster Trust Extension. (Mr. E. Wingfield-Bowles, consulting engineer):—

			Total.
Roger Dawson & Co.	£10,490	£7,680	£18,170
Buchanan & Curwen	9,057	6,018	15,075
Higgins & Griffiths	7,650	5,426	13,076
Foote & Milne	7,968	4,829	12,797
Rawlings Bros., Ltd.	7,536	4,812	12,348
G. E. Taylor & Co., ...	6,830	5,289	12,080
Tyler & Freeman	6,870	4,920	11,790
Leo. Sunderland & Co.	6,949	3,950	10,899
Donnison, Sillem & Co.	8,290	1,993	10,183
Blackburn, Starling & Co. .. (accepted)	4,269	3,730	7,999

Morecambe.—The following tenders were received by the Committee for the supply of superheaters, (consulting engineer, Mr. W. R. Wright):—

Mc. Phail & Simpson .. .. (recommended)	£135	Delivery 4 weeks.
A. Bolton & Son	147	" 2 "
Galloways', Ltd.	150	" 5 "
James Gordon & Co.	154	" 6 "
T. Sugden, Ltd.	155	" 3 "
Tinkers, Ltd.	160	" 2-3 "
John Thompson	174	" 6 "
Musgrave & Sons, Ltd.	179	" 9 "
Mechan & Sons	189	" 6 "
Heenan & Froude	339	" 6 "

Salford.—An order has been placed with Mather & Platt, Ltd., for 50 commutator bars of H.D. copper, at £22 10s., and for moulded mica segments, at £16.

Southampton.—The T.C. has accepted the tender of Gent & Co., Ltd, Leicester, at £83, for laying cable for the Water Department, also the tender of the United Electric Co., for six Brill trucks for the Tramways Department, at £40 each.

Uxbridge.—The U.D.C. has accepted the tender of Messrs. Glenfield & Kennedy, at £50 10s., for an electrical tell-tale apparatus for the Waterworks Department.

FORTHCOMING EVENTS.

Northampton Institute Engineering Society.—Friday, March 4th. Paper on "D.C. Liquid Starters," by Mr. J. K. Hwoo.
Saturday, March 5th. Visit to Robertson's Lamp Works.

Royal Institution. — Friday, March 4th. At 9 p.m. Discourse on "Magnetic Storms," by Mr. C. Chree.
Saturday, March 5th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson. (Lecture IV.)
Friday, March 11th. At 9 p.m. Discourse on "Ionisation of Gases and Chemical Change," by Mr. H. B. Baker.
Saturday, March 12th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson. (Lecture V.)

Institution of Electrical Engineers (Manchester Students' Section).—Saturday, March 5th. Visit to the Birkenhead works of the English McKenna Process Co., Ltd.

P. & O. Batti-wallahs' Society.—Saturday, March 5th. At 7 p.m. At the Holborn Restaurant. Annual dinner.

Sheffield Society of Engineers and Metallurgists.—Monday, March 7th. At 8 p.m. At the University, Sheffield. Lantern lecture on "The Place of the Electric Furnace in the Iron and Steel Industry," by Mr. G. Hooghwinkel.

Institution of Electrical Engineers (Manchester Section).—Tuesday, March 8th. At 7.30 p.m. At the University, Manchester. Paper on "The Short-Circuiting of Large Electric Generators, and the Resulting Forces on Armature Windings," by Mr. M. Walker.

Institution of Electrical Engineers (Glasgow Section).—Tuesday, March 8th. At 8 p.m. At 207, Bath Street, Glasgow. Meeting.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, March 9th. At 7.30 p.m. At the University, Birmingham. Paper, "Some Notes on Standardisation of Electrical Machines," by Mr. R. Orsettich.

Association of Engineers-in-Charge.—Wednesday, March 9th. At 7.30 p.m. At the St. Bride's Institute, E.C. Paper on "The Application of Recording Instruments to Steam Generation," by Mr. J. Abady.

Institution of Electrical Engineers (London).—Thursday, March 10th. At 8 p.m. At the Institution of Civil Engineers. Papers on "The Short-Circuiting of Large Electric Generators," and "The Design of Turbo Field Magnets for A.C. Generators, with Special Reference to Large Units at High Speeds," by Mr. M. Walker.

Physical Society.—Friday, March 11th. At 8 p.m. At the Royal College of Science, South Kensington, S.W. Papers on "Coherers," by Mr. W. H. Eccles, and "Earth-Air Electric Currents," by Mr. G. C. Simpson.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are announced:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, March 7th.—"A" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.

Tuesday, March 8th.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, March 9th.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, March 10th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, March 11th.—"D" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.

Saturday, March 12th.—"C" Company. Week-end run at Coalhouse Fort. Parade and dress as usual.

(Signed) J. H. S. PHILLIPS, Capt. Acting Adjutant.
For O.C. E.E., L.D.

NOTES.

Parliamentary. — IRISH TELEGRAPHIC SERVICE.—Several questions have been addressed to the Postmaster-General by Mr. Joyce, Mr. Lonsdale and Mr. Devlin respecting the Irish telegraphic service, and Mr. H. Samuel, in reply admitted that there had been breakdowns owing to the severe storms, which have caused much inconvenience. A sum of £1,500,000 had been spent by his predecessors in laying about 1,000 miles of underground cables along the main lines of communication. He proposed to continue this policy, and a considerable sum would be included for the purpose in this year's estimates. The extension of the underground cable system to the large towns of South Wales, and from there to the landing places of some of the Irish cables was under consideration.

TRUNK TELEPHONES.—Mr. J. P. Farrell, on Monday, asked the Postmaster-General what progress, if any, had been made with the proposed introduction of the trunk telephone from Dublin to Galway, Sligo and Cavan respectively. Mr. H. Samuel (Postmaster-General) replied that an extension of the trunk telephone system to Athlone was being carried out, but a guarantee in respect of a further extension to Galway was not at present forthcoming. He was in correspondence with the Treasury with regard to the acceptance of a local guarantee for an extension to Sligo. An extension to Cavan could not be undertaken until a guarantee had been given for an extension to Clones.

UNDERGROUND CABLES.—On Tuesday, Mr. Wilkie put further questions to the Postmaster-General with respect to the failure of the telegraph to Dundee and the North-West of Scotland, and asked if he would have the lines placed underground without further delay. The Postmaster-General replied that in view of the very heavy cost of laying these cables, and the many claims which had to be considered, he saw no present prospect of laying lines to Dundee and the North-East of Scotland. A considerable part of the expenditure on underground cables already incurred was on the line from London to Edinburgh, by every mile of which Dundee and places beyond benefitted.

ALLOWANCES FOR OBSOLETE MACHINERY. — Replying in the Parliamentary Papers to several questions by Mr. Nield, the Chancellor of the Exchequer stated that the determination of claims for allowance in respect of obsolete machinery rested with the District Commissioners of Taxes, and not with the Surveyors of Taxes. Answering a further question in respect of income-tax allowances for depreciation, Mr. Lloyd-George said that so far as depreciation of plant and machinery was concerned, there was no restriction in the sum the Commissioners of Taxes may, in their discretion, allow; but he did not think it would be either feasible or desirable to adopt uniform rates for each particular trade, owing to the variety of machinery and plant used and the divergent circumstances in which it was used.

Late Legal.—EDWARD LE BAS *v.* STIRLING BOILER CO., LTD.—In the High Courts on Tuesday, the Official Referee gave judgment in an action brought by Edward Le Bas, trading as Edward Le Bas & Co., of Glebe Place, Stoke Newington, against defendants to recover £194, balance alleged to be due for work done in connection with the erection of steam pipes, &c., at the Shoreditch Borough Council's electric lighting station. The defendants, as contractors, invited plaintiffs to sub-contract with them. A dispute arose which led to the above claim. The learned Referee having reviewed the facts, held that the defendants had already paid sufficient to satisfy plaintiffs' claim, and gave judgment in their favour with costs.

ETHELBURGHA SYNDICATE, LTD., *v.* INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., AND ANOTHER.—In the King's Bench Division on Wednesday, this case was commenced. It was an action for damages for alleged breach of contract to lay a cable between Columbia and Jamaica, and the action was also brought against Mr. R. K. Gray for breach of warranty of authority in respect of the same matter. The defence was a denial of the alleged breach. Mr. Eldon Bankes, K.C., opened for plaintiffs. Evidence having been given by Mr. A. Pam and by Mr. F. M. Voules, a director of the plaintiff company, the hearing was adjourned.

Institution and Lecture Notes.—INSTITUTION OF MINING ELECTRICAL ENGINEERS (SOUTH WALES SECTION).—A meeting of the Section was held on February 26th, at Cardiff, at which the subject of "Electric Shocks," dealt with by the President (Mr. W. Maurice) in his paper, and "The Causes and Means of Preventing Electrical Accidents in Mines," was discussed. The President of the Local Section (Mr. S. F. Walker) opened the discussion, and Mr. Richards (Mastey), strongly advocated a properly-organised and well-trained staff of ambulance men connected with the electrical department of the colliery, and systematic and periodical examination of the entire installation wherever possible. Measures should be taken to thoroughly insulate and protect all frames, guards, railings, &c. Armoured cables should be used in-bye in preference to any other, and should have their sheathing efficiently earthed and bonded, especially at joint boxes, &c.

Mr. Stone (Mountain Ash) thought that the only perplexing question to the electrical engineer was, "Can they devise some means of efficiently 'earthing' the whole installation, coupled with positive connection throughout." There was no more economical pressure to use than a medium pressure of 550 volts for work in a mine. At their colliery they generated at 3,500 volts and stepped it down at the pit to 550 volts. The method of earthing he adopted at his station was to centralise the earth-plate on the surface and link up every piece of apparatus underground and on the surface. This method had proved very satisfactory.

Messrs. Brodie, Fokes and Phillips also took part in the discussion.

Mr. E. Ivor Davies having resigned the secretaryship, Mr. Geo. Humphry, 113, Clive Road, Canton, Cardiff, was elected in his place.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—The annual dinner of the Manchester Section of the I.E.E. was held on the 25th ult. Mr. S. J. Watson presided, and about 180 members and visitors were present, including the Vice-Chancellor of the University of Manchester, Dr. Kapp, president of the Institution, Dr. E. Hopkinson, Mr. W. M. Mordey, the Mayor of Salford, and Mr. Councillor Howarth. After the loyal toasts, Mr. H. Hirst proposed "The Corporations of Manchester and Salford." He said the Manchester district was acknowledged to be the Mecca of the electrical industry. Manchester had also the finest electrical undertaking in the country, and its chief engineer, Mr. S. L. Pearce, was a monument of the profession both practically and commercially. The Mayor of Salford and Mr. Councillor Howarth (chairman of the Manchester Electricity Committee) replied. The latter said that Manchester had done as much as, if not more, than other municipalities, but even they had only just shown what was possible. He also paid a splendid tribute to the staff, and said the department was on a very sound footing.

The Vice-Chancellor of the University (Mr. Alfred Hopkinson, K.C.) proposed the toast of "The Institution of Electrical Engineers." Dr. G. Kapp, in replying, said that in itself science was a barren tree, and only a means to an end. The Institution existed for the advancement of science, and its application for the use and benefit of man. The Council had always taken that view, but there were others that wanted them to widen it. There had lately been some correspondence and severe criticism in the Press, because they would not support a movement for promoting private aims. The Institution would not make itself a machine for the promotion of selfish interests. If the matter was of general interest, or the Government imposed unjust regulations, it would then step in. A short time ago a speaker at one of the

meetings said they would do no good unless they had Tariff Reform. He objected to politics in the Institution. It would be dangerous for the profession as a body to pronounce for Tariff Reform or Free Trade. If they stood for the former they might offend Lancashire, and if they supported Free Trade they would upset Birmingham and the Midlands. At the present time the Government Departments—the Board of Trade and Home Office—had confidence in them, because of their strict impartiality, and they had been consulted by, and had advised, the Home Office lately on the question of the use of electricity in mines. He suggested that this Section of the Institution should endeavour to show the owners of cotton mills, &c., the advantages to be gained from the use of electrical driving. He understood that a Committee appointed by the Bradford Engineering Society, and composed of mechanical and electrical engineers, had considered this matter, and had issued a report. On that Committee the mechanical engineers were in the majority. He thought a counter-blast should be issued to that report.

Mr. W. M. Mordey proposed "The Local Sections," and referred to the new system which he had initiated whilst president, as to the reading of papers. He knew that some of them objected to this method, but he hoped they would defer their criticism until the system had had a fair trial. He considered that it would be far better to have a smaller number of papers by the best authors read in each of the Sections, than a large number of papers of inferior value. They must resist all efforts to make the Institution a masters' association or a trade union.

Mr. S. J. Watson (chairman), in his reply, said the president had mentioned the question of textile driving. At the present moment there was no subject which interested them as a Local Section to a greater extent than the supply and use of electrical apparatus in the great industry of that particular county. He noticed one of the electrical papers had made reference to the Bannerman mills in Manchester. It was distinctly stated in the particulars therein given, that the management was exceedingly pleased with the extra amount of work which was being turned out, and the better quality of the work which was being obtained. At a recent Local Government Board inquiry at Bury, he had had the opportunity of putting forward a spinner, who stated that he was obtaining better results with the electrical drive than he had ever obtained with either steam or gas. The Manchester Local Section was proud of the Institution and of the position it occupied with regard to Institution matters generally. In that section they were inclined to think that London was the local section, and that Manchester was the centre of the Institution. He ventured to think that it would perhaps be to the advantage of the London Council at some future time to consider whether local sections should not have a larger representation on the Council than they now possessed

Mr. J. S. Peck proposed "The Visitors," to which Mr. W. T. Stubbs, President of the Manchester Chamber of Commerce, replied.

Railway Signal and Telegraph Engineering Institute.—This Institution, which was founded in October last, has made remarkable progress, counting already 200 members; its objects are pretty well indicated by its title and it is being well supported by the great railway companies. Mr. G. E. Gurney, of the London Underground Electric Railways, is the hon. secretary, and may be addressed at 6, Montrose Crescent, Wembley, Middlesex. The fees are very modest, and the chief qualification for membership is six months' railway service.

At a recent meeting Mr. W. J. Thorrowgood (L.S.W.R.), vice-president, read a paper on dry-core cables for railway work, which was followed by an interesting discussion.

Royal Society.—Amongst the candidates recommended by the Council for election as Fellows are Dr. J. A. Harker, Prof. B. Hopkinson and Mr. F. Soddy.

Institution of Municipal Engineers.—The roll of the Institution now stands at 697 members and 96 students, making a total of 793.

Institution of Mechanical Engineers.—According to a New York dispatch to the *Pall Mall Gazette*, the response to the invitation of the Institution of Mechanical Engineers to the American Society of Mechanical Engineers to be its guest this summer, and hold a joint meeting at Birmingham, July 26th-29th, has been so satisfactory that a representative attendance is ensured. Mr. George Westinghouse is president of the American Society this year, and papers on "The Electrification of Railways" are to be presented by him and Mr. William B. Potter, chief engineer of the railway and traction department of the General Electric Co.

Sir Wm. Mather's Generosity.—According to the *Times*, Sir William Mather (Mather & Platt, Ltd., engineers, Salford) has placed £10,000 in trust with a direction that the income arising therefrom shall be distributed annually among the firm's workpeople on the occasion of their annual holiday.

Joint Publicity.—The scheme of the Electricity Supply Publicity Committee, to which we made reference in our leaderette on "The Sale of Units" last week, is stated to have received considerable support. In addition to all the leading London companies and municipalities, a large number of provincial companies have already joined in the movement, and a number of others are to report after their Committees have been consulted. The following is a list of the provincial districts which have so far decided to support it:—Loughborough, Harrogate, Nuneaton, Lowestoft, Midland Co. (Leamington), Aberdeen, Blackpool, Gosport, Leatherhead, Newmarket, Weymouth, Wolverhampton, Dundee, Derby, Devonport, National (Preston), Mansfield, Grimsby, Tunbridge Wells, Ipswich, Northampton, Southampton, Hanley, Ross, Bournemouth, Coatbridge.

Cinematograph Regulations.—New regulations relating to cinematographic exhibitions in England have been issued under date February 18th, and are published in the *London Gazette* of February 25th. Alterations have been made in several of the old regulations; those which are of special interest to electrical men are reproduced below. It will be observed that, as is pointed out in a covering letter separately issued by the Home Office, words have been added in Clause 12 (*b*), so as to allow (*e.g.*, in the case of an A.C. supply) both leads to the lamp to be taken within the same pipe or casing; and the last sentence in Clause 12 (*c*) makes it clear (1) that it is only when the cinematograph lamp is working that the pressure of current inside the enclosure is not to exceed 110 volts, and (2) that this limitation applies only to the pressure across the terminals of the D.P. switch in the cinematograph lamp, and not to any pilot light in the enclosure. Clause 12 (*d*) is largely new. We trust that these amendments will clear up the doubts expressed by so many of our correspondents:—

Lighting.

10. Where the general lighting of the auditorium and exits can be controlled from within the enclosure, there shall also be separate and independent means of control outside and away from the enclosure.

Electric Light.

12.—(*a*) Within the enclosure the insulating material of all electric cables, including "leads" to lamps, shall be covered with fire-resisting material.

(*b*) There shall be no unnecessary slack electric cable within the enclosure. The "leads" to the cinematograph lamp shall, unless conveyed within a metal pipe, or other suitable casing, be kept well apart both within and without the enclosure, and shall run so that the course of each may be readily traced.

(*c*) Cables for cinematograph lamps shall be taken as separate circuits from the source of supply and from the supply side of the main fuses in the general lighting circuit, and there shall be efficient switches and fuses inserted at the point where the supply is taken, and, in addition, an efficient double-pole switch shall be fitted in the cinematograph lamp circuit inside the enclosure. When the cinematograph lamp is working, the pressure of the current across the terminals of the double-pole switch inside the enclosure shall not exceed 110 volts.

(*d*) Resistances shall be made entirely of fire-resisting material, and shall be so constructed and maintained that no coil or other part shall at any time become unduly heated (*e.g.*, they should not become so heated that a piece of newspaper placed in contact with any part of the resistance would readily ignite). All resistances, with the exception of a resistance for regulating purposes, shall be placed outside the enclosure, and, if reasonably practicable, outside the auditorium. If inside the auditorium, they shall be adequately protected by a wire guard or other efficient means of preventing accidental contact.

The operator shall satisfy himself before the commencement of each performance that all cables, leads, connections and resistances are in proper working order. The resistances, if not under constant observation, shall be inspected at least once during each performance. If any fault is detected, current shall be immediately switched off, and shall remain switched off until the fault has been remedied.

Mono-rail Trains.—A demonstration of the Brennan mono-rail system took place last week at Gillingham, in the presence of a large number of distinguished visitors. A car ran round the track at speeds up to 22 miles an hour, carrying about 50 passengers at a time, and its capabilities were fully demonstrated.

Appointments Vacant.—Commercial assistant for the Battersea Borough Electricity Department. Mains superintendent, for the Burgh Electricity Works, Motherwell. See our advertisement pages to-day.

Gas and Electric Cables.—A correspondent, who is responsible for a system of underground mains, double steel armoured and lead covered, laid direct in the ground, has found the armouring, bitite yarn and lead completely eaten through in places where he has also found leakages of gas. There appears to be more than a chance connection between the two circumstances, and he would be glad of any information bearing on the point that any of our readers may be willing to furnish.

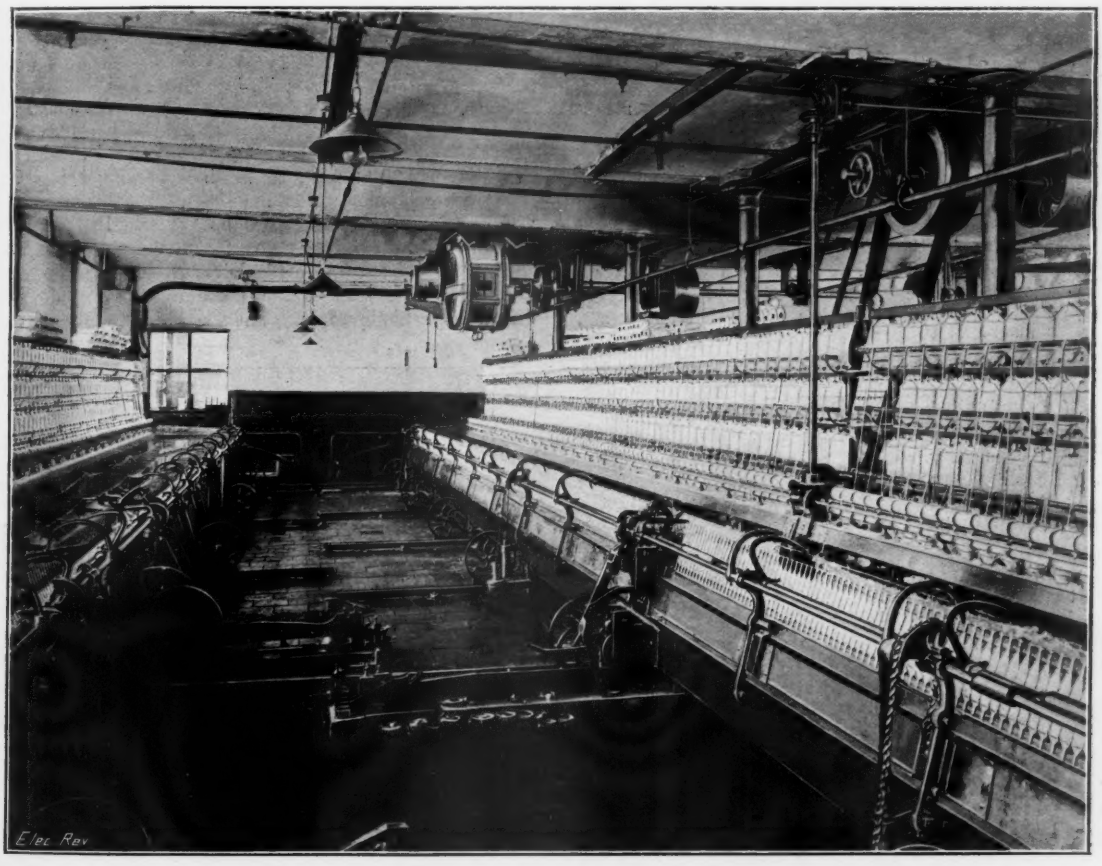
A Dordrecht Exhibition.—An Exhibition of Electricity in Home and Factory is being organised by the Dordrecht Department of the Dutch Industrial Society, and it is to be held in Dordrecht, Holland, from April 30th to May 16th. We are assured that it promises to be a success. Besides the representatives of France, Germany and Belgium, the English Consul has also joined the Committee, and various important foreign firms have promised their co-operation. The Exhibition will take place at the same time as the opening of the Municipal Electrical Station, so that English industry, being represented at the Exhibition, may find new outlets at Dordrecht. No import duties will be levied on goods sent to the Exhibition, and railway companies will not charge for return freight. A reference to the Exhibition appears in our advertisement pages to-day.

Canada.—H.M. Trade Commissioner for Canada (Mr. R. Grigg) reports that the four principal electrical producers in Quebec have amalgamated, and that an expenditure estimated at $1,000,000 (about £205,000) is likely to be incurred in consequence. The names of the general manager and the electrical engineer of the new organisation may be obtained by British firms interested on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

ELECTRICAL DRIVING INSTALLATION AT THE BANNERMAN MILL CO.'S BRUNSWICK MILL, MANCHESTER.

There has been a considerable amount of correspondence and controversy recently in regard to the electrical operation of textile mills. Many mechanical engineers are evidently of the opinion that the electrical operation of such works has not demonstrated its utility, and that it has not been proved that electrical operation is in any way superior to the ordinary means of transmission by ropes and belts. Despite this opinion, however, both expressed and inferred, it is instructive to note that during the last five years, since the first electrically-operated mill was set to work, viz., the Acme Spinning Co.'s mill at Pendlebury, electrical driving to the extent of some 50,000 B.H.P. in alternating-current induction motors has been installed in the United Kingdom, and that to date there is in the region of 300,000 B.H.P. of motors installed in similar mills in the United States alone. The Continent also is responsible for the installation of motors to a considerable extent. This is conclusive evidence of the remarkable progress electrical driving has made since its introduction in the United Kingdom. It is also instructive and significant that of the 50,000 B.H.P. in operation here, approximately 20,000 B.H.P. are driven by current supplied from outside sources.

One of the latest electrical installations to be set to work in the United Kingdom is the Brunswick Mill of the Bannerman Mills Co., Ltd., Bradford Road, Manchester. This mill is one of a very old-established concern, and has been run for many years in the ordinary way, by steam engines and the power transmitted to the various mill rooms by means of belt, rope and gear drives. The mill has for several generations been continuously and successfully driven in this manner, and it required, on the part of the mill authorities, considerable confidence in the reliability and commercial economy of electrical transmission to depart from their time-honoured method of driving. It is, however, characteristic of the enterprise and foresight which have invariably distinguished the career of the managing director of this company, Mr. C. W. Macara, the well-known president of the English Federation of Master Cotton Spinners' Associations, and of the International Federation of Master Cotton Spinners' and Manufacturers' Associations, that after exhaustive investigations had been made it was decided to place the continuity of the running of the mill in the hands of an outside source of power—viz., the Electricity Department of the City of Manchester.



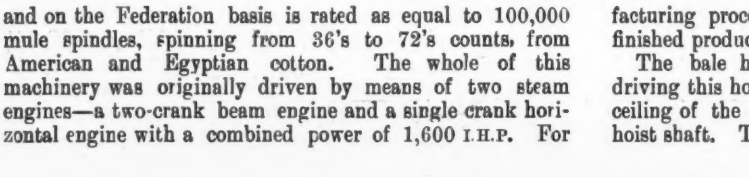
View Showing Electrical Drive in the Wing Mule Room, Brunswick Mill, Manchester.

The installation now completed has, we understand, amply justified the confidence shown in the electricity department, and the arrangement between the two parties may be cited as an example of the enormous influence a centralised electric power supply may exert in the industrial development of a district.

The installation, carried out by the British Thomson-Houston Co., Ltd., electrical engineers and manufacturers, of Rugby, under the general supervision of the City electrical engineer, Mr. S. L. Pearce, M.Inst.C.E., M.I.E.E., &c., is one of the largest single mill equipments at present working electrically in the United Kingdom.

The mill contains both mule and ring spinning spindles,

and on the Federation basis is rated as equal to 100,000 mule spindles, spinning from 36's to 72's counts, from American and Egyptian cotton. The whole of this machinery was originally driven by means of two steam engines—a two-crank beam engine and a single crank horizontal engine with a combined power of 1,600 I.H.P. For transmitting the power from these engines to the various rooms in the mill, spur and bevelled gears and upright shafts from the large beam engine were adopted, and rope driving with bevelled gears from the small horizontal engine. By adopting the electrical drive, practically all of these gears and upright shafts were dispensed with, and to-day there remain in the mill only two small pairs of bevelled gears, one at the foot and the other at the top of an upright shaft, which, for purely local reasons, have been allowed to remain for driving a small amount of light machinery in the east wing of the mill.



Rope Transmission in Spinning Room, Providing for Three Speeds.

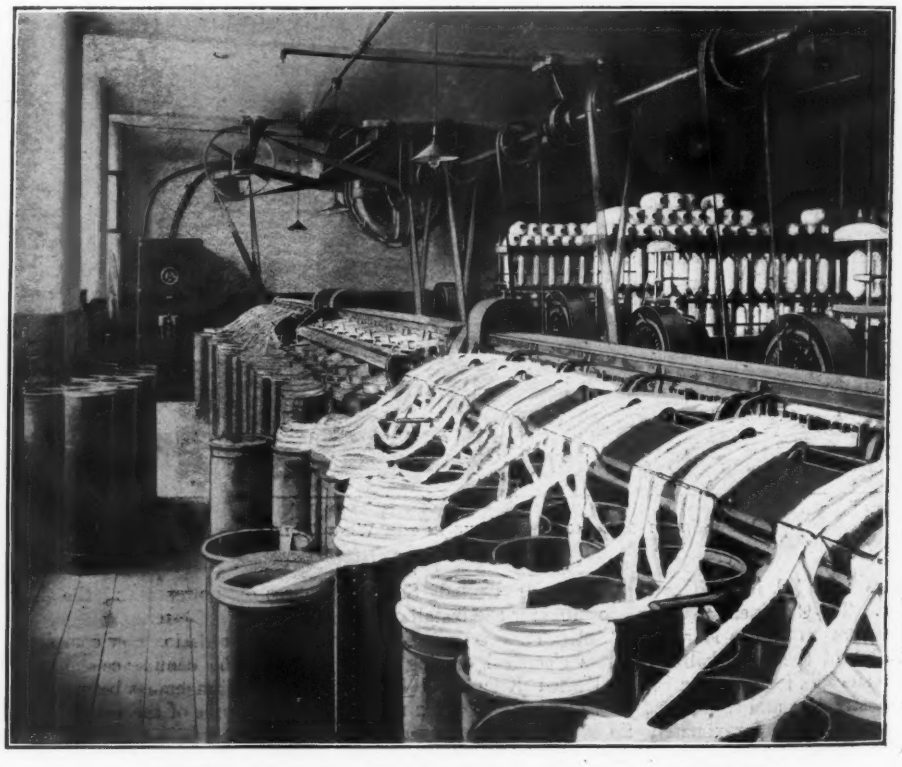
The mill to-day is driven throughout from the mains of the Manchester Corporation by means of three-phase induction motors, working on a 400/415-volt supply at a frequency of 50 cycles per second. The current for driving the mill is supplied from the mains at 6,500 volts; a duplicate set of mains being carried to a sub-station arranged in the basement of the original small engine house. It is there transformed from 6,500 volts to a working pressure of 400/415 volts for the motors, and to 220 volts for lighting purposes. The mill contains in all 37 motors aggregating 1,639½ B.H.P.

In describing the methods adopted for driving, it is proposed to commence at the point at which the raw cotton is received in the mill, and follow it through the various manufacturing processes until it is ready for despatch as the finished product.

The bale hoist is situated in the west wing, and for driving this hoist a small motor is installed, inverted on the ceiling of the blowing room and driving by belt on to the hoist shaft. There is, therefore, no current consumption at this point, except at those times when the hoist is actually working.

For driving the bale breaking, mixed lattices, and blowing room machinery, a special motor of 45 B.H.P. is installed in the blowing room directly connected by a flexible coupling to the line shaft, from which the blowing room machinery is driven. This line shaft now runs at 480 R.P.M., having been speeded up from its original speed and the line shaft pulleys altered accordingly. The line shaft driving the bale breaking and mixing room is driven from this shaft by belt. The motor is of the slip-ring type, and is started by means of a triple-pole automatic-trip oil switch and a totally-enclosed metallic starting rheostat mounted on a panel erected close to the motor.

The main card room, situated on the first floor of the main mill, and containing 112 cards and 16 preparation frames, is driven by a 150 B.H.P. slip-ring type motor, directly connected to the main card line shaft, which is running at 290 R.P.M., a flexible coupling being fitted between the motor and the line shaft. In this room there were originally three main lines of shafting. By the installation of electrical driving one of these lines was dispensed with, and two rows of cards driven from one shaft placed between the two rows, the remaining line shaft being driven from this by ropes. The starting apparatus for this motor is a triple-pole automatic-trip oil switch, and totally enclosed metallic starting rheostat mounted on a suitable panel placed close to the motor.



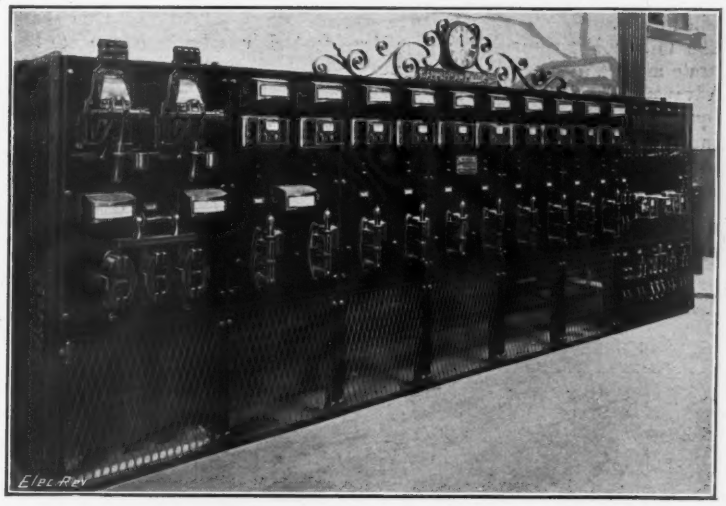
Frame Room, Brunswick Mill, Showing Motor Drive and Switchgear.

The speed frame room, containing 64 drawing, slubbing, intermediate and roving frames, is situated on the second

floor of the main mill. This room is driven by means of a 130-B.H.P. slip-ring type motor, directly connected to the main line shaft by a flexible coupling, running at 485 R.P.M., the installation being generally similar to that in the card room mentioned previously. In both these cases, since the rooms driven contain preparation machinery, and the atmosphere is often charged with cotton dust, it has been found advisable to cover in each of the motors with a sheet-iron case connected by shallow air trunks with the outside atmosphere, a small electrically-driven fan being installed for drawing air from the outside of the mill on the one side, through the motor, and out again to the other side of the mill.

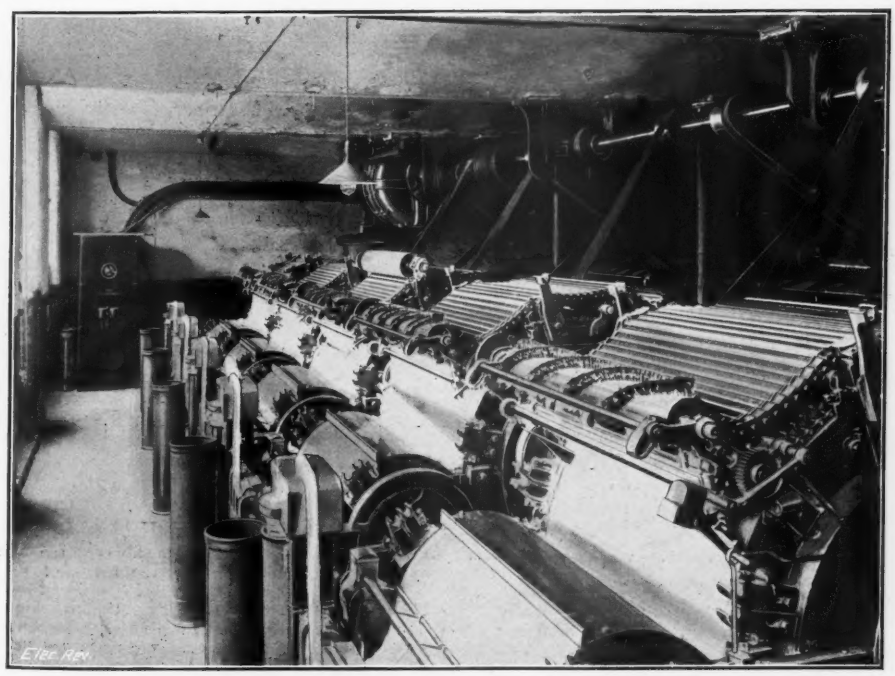
Two small roving rooms, one in each of the two wings, are each driven by an 18-B.H.P. squirrel-cage type motor, directly connected by a flexible coupling to the line shaft running at 475 R.P.M.; each of these motors is started by an oil immersed star-delta starting switch, situated close to the motor.

The ground floor, and the third, fourth, fifth and sixth floors in the main mill, each containing four pairs of mules and ten ring frames, presented one of the most difficult problems for solution, and the method adopted for driving these rooms is undoubtedly one of the most interesting features in the entire installation. The positions of the machines in the various flats rendered it practically impossible to group more than two pairs of mules on each motor. This in itself was a somewhat difficult requirement, inasmuch as the power demand for driving this particular class of machine varies to a considerable degree, the maximum demand being at the very least twice the minimum and the cycle of operations being comparatively rapid. A further serious consideration affecting the method of procedure to be adopted was the necessity for such an arrangement as would enable the mill to continue its ordinary working during the change over. The method adopted, therefore, to drive these flats was to build two motor towers, one at each end of the mill on that side of the mill nearest the courtyard. The towers, which are independent of the main mill structure, are built entirely of steel framing and glazed casing, no brickwork being used. In each of these towers two motors per floor are installed for driving each spinning room, there being in all ten motors per tower. Each of the motors for driving the mules is of the slip-ring type rated at 75 B.H.P. running at 485 R.P.M., and coupled directly to the mule line shaft by means of a flexible coupling. Each of these line shafts runs the full width of the mill, and drives by belt the four countershafts for the mules, special pulleys being provided on the line shafts to suit the increased speed.



The Main Switchboard, Brunswick Mill.

The ten ring frames which are situated in two lines along the middle of each spinning room are divided into groups of four and six, and, owing to the fact that it was necessary to provide that the mill authorities could conveniently alter the speed of these frames to suit the various counts to be produced, a novel and ingenious system of rope transmission, which provides for three changes of speed at the spinning frame, was adopted.



View in the Card Room, Showing Motor Drive and Switchgear.

The six frames on each floor at the western end of the mill are driven from a line shaft carried half-way across the room and running at 725 R.P.M. (probably the fastest running line shafts in the world driving ring-spinning frames), a squirrel-cage type motor of 45 B.H.P. capacity being directly coupled to the line shaft by means of a flexible coupling. Rope pulleys of special design to provide the three changes of speed required are installed on the line shaft, the frames being driven by ropes over adjustable gallows pulleys.

The four-ring frames on each floor at the eastern end of the mill are driven in a similar manner from a line shaft running at 725 R.P.M., directly coupled to a 30-B.H.P. squirrel-cage type motor, there being in all five floors driven in this manner.

The starting apparatus for each of the motors in the two towers is arranged in the towers, on the same floor as the

motor, and a special arrangement of emergency push buttons is fitted in each room, so that in case of necessity any motor may be stopped from the inside of the mill.

The winding and beaming machines situated on various floors of the east wing are driven by means of an 18-B.H.P. motor, 475 R.P.M., squirrel-cage type, driving by belt on to a line shaft, the power being transmitted to the various floors by means of a light upright shaft and two pairs of bevelled gears.

The mill hoists throughout the mill are each driven by separate motors, as also is the mechanics' shop.

Advantage has been taken of the alterations carried out to equip the mill throughout with sprinkler apparatus, the sprinkler tank being arranged on the top of the eastern motor tower. The supply of water to this tank is by means of an electrically-driven high-lift turbine pump, provided with special starting apparatus, which automatically starts up the motor, in order to keep the tank filled, when any of the sprinklers in the mill are in operation. The pump continues to run and supply water until it is shut off by hand.

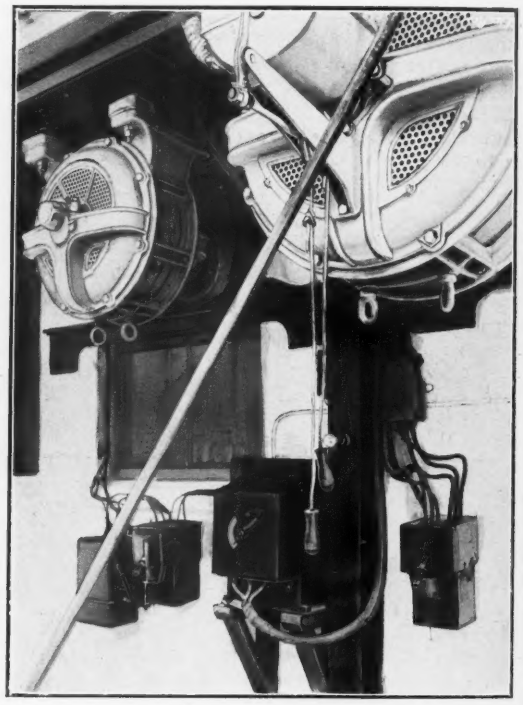
A further special feature of the installation is the main mill switchboard, providing current for the various motors. This board is arranged on the first floor of the original small engine house, being therefore situated directly over the Corporation sub-station. There are in all 10 main motor feeder circuits on this board and one incoming feeder circuit, also one main lighting board. Each of the motor feeder circuits is fitted with a triple-pole oil switch having automatic overload cut-outs, and further, each circuit has a polyphase indicating wattmeter and polyphase integrating wattmeter installed. These instruments enable the mill authorities to read at any moment the exact amount of power being consumed on each circuit, and also to "log" periodically the amount consumed during any period. The information obtained in this manner by the mill authorities has proved of distinct service to them, forming, as it does, a complete check on the operation of each department.

The distributing mains and branch cables between the mill switchboard and the various motors are of the three-core steel tape armoured type throughout, and are carried along and fixed to the mill walls and ceilings. Where more than one motor is fed from the same circuit, enclosed distributing fuse boxes are installed, each of the three phases being in a separate box. The whole of the distributing boxes for the main mill motors are erected on a steel framework on the first floor level of the western motor tower, from which separate cables are run to each motor. The distributing boxes for the two wings of the mill are erected on the landings by the staircases.

The mill is lighted by about 1,000 carbon-filament 220-volt lamps, a separate three-phase lighting transformer being installed to provide this lighting current, and the mill circuits being arranged so as to preserve the balance of load between phases. The wiring throughout is carried in heavy-gauge steel-screwed tubing, fixed to the mill walls and ceilings, the whole being in strict accordance with most recent practice and requirements of the fire insurance offices.

As a result of the experience to date, the mill management are able to make a definite pronouncement that they are obtaining from the same machinery a larger production, and they are of opinion that the more regular turning obtained gives an improved quality of yarn. This statement, coupled with the fact that the manufactures of this company have always been of the highest grade, is eloquent testimony to the advantages which accrue from the application of electrical power to the textile industry.

Transformers and Switchgear, Brunswick Mill Sub-station.



Motors in Towers, Driving Line Shafting.

Congratulations are due to the British Thomson-Houston Co., on having carried out this installation, which, by its successful operation, should materially influence the progress of this class of work in the Lancashire factories.

Human Telegraphy.—Prof. W. W. Haldane Gee, says the *Birmingham Post*, has laid before the members of the Manchester Literary and Philosophical Society the result of some recent experiments on the electrical resistance of the human body, made at the Municipal School of Technology. Under ordinary circumstances the resistance was about 1,500 ohms, but when an alternating current was used, the resistance was much less, being about 700 or 800 ohms on the average. A greater muscular contraction is experienced on closing the cathode than on closing the anode, so that by moistening the fingers and touching the ends of two wires on the ordinary 110-volt circuit of the city it is possible to distinguish the cathode or negative pole from the anode or positive pole; Prof. Gee has developed a mode of telegraphing based on this suggestion, and the experiment was performed of sending signals from another room, which were interpreted in presence of the members by an operator who acted as a telegraphic receiving instrument, his hands being immersed in separate solutions of salt. A slight shock in one hand corresponded to a dot, and in the other to a dash, in the ordinary code. This method, it was pointed out, might be of great value in an emergency.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Last week the Farnworth Electricity Committee considered an intimation from Mr. R. B. Leach, that he did not desire a renewal of his engagement as resident electrical engineer, and it was resolved that his resignation be accepted. It was resolved to appoint him for 12 months as consulting electrical engineer at £75 per annum, and Mr. H. A. Hutchinson was appointed resident electrical engineer at £180 per annum. Mr. Hutchinson has been assistant engineer at the works for several years. Mr. Leach resigned his position in order to take up consulting and other private work, and he is opening offices in Manchester for this purpose. His appointment at Farnworth has extended over five years, and he was responsible for all the extensions and the re-designing of the old works, as well as for the bulk-supply scheme from the Lancashire Electric Power Co., the destructor, &c.

Dudley T.C. has appointed Mr. Ernest Bennett as assistant engineer at the generating station.

The Croydon Council on Monday increased the salary of Mr. Daniel Cowan, mechanical superintendent at the electricity works, from £200 to £210 per annum, with annual increments of £10, rising to a maximum of £230. In addition, he occupies a cottage at the works.

Mr. E. Staples, of West Ham, has been appointed chief clerk and accountant at the Croydon electricity works.

Longton Gas and Electricity Committee recommends that the salary of the electrician, Mr. Chas. Cuthbertson, A.M.I.E.E., be increased from £160 to £170.

The Bridlington Corporation has appointed Mr. Frank Crooks, of Wakefield, chief clerk in its electricity department.

Tramway Officials.—On Thursday evening last week the employés of the Paisley District Tramway Co. held their annual dance. A company numbering close on 160 sat down to supper in the Recreation Hall at Elderslie Depôt, under the chairmanship of Mr. Fred. Coutts, the general manager, who gave some interesting statistics regarding the staff, which at present numbers 188. Of these, 140 are Scotch, 37 Irish, 9 English, 1 a Jew, and 1 a Manxman. Provost Armour, of Johnstone, kept the company in high good humour by his stories. Supper was succeeded by a short concert, the selections of an orchestra under the leadership of Mr. Smith. The company were then conveyed by special cars to the Paisley Skating Rink, which had been kindly placed at their disposal by Mr Bostock. Dancing was engaged in until the small hours. During the evening Mr. Jack Bostock was made the recipient of a desk clock as a token of appreciation from the tramway men, and as a tangible expression of their congratulations upon his coming of age. Inspector McAulay was also presented, on the occasion of his marriage, with a handsome marble timepiece. During the week, Mr. Nicol Creighton, who lately was an inspector with the company, but who left to take up an appointment in town, was presented with a writing cabinet. Mr. Coutts, in making the presentation, thanked Mr. Creighton personally for his ungrudging efforts on behalf of the ambulance corps.

The Manchester Corporation Tramways Committee's minutes, presented to the City Council on March 2nd, include a recommendation that an arrangement be made with Mr. J. M. McElroy, the general manager of the Corporation tramways, by which he is to agree to remain in the service of the Corporation for five years; that his salary of £1,000 per annum be increased by annual sums of £50 till £1,250 be reached, the latter figure to be considered the maximum for the position.

Mr. Hett, resident engineer to the Torquay Tramway Co., is shortly leaving for Canada.

The Middlesex County Council has raised the salary of Mr. A. J. Lander, chief assistant in the Tramways Department of the county engineer, from £450 to £475 per annum as from January 1st last.

Mr. Archibald Robertson, manager of the Rothesay tramways Co., has been appointed manager of the tramway undertakings in Scotland controlled by the British Electrical Federation—namely, the Greenock and Port Glasgow, Airdrie and Coatbridge and Rothesay systems, with headquarters at Greenock. Mr. H. H. Hill will be responsible for the working of the Rothesay Co.

Mr. A. R. Foskett, to whose new appointment we alluded last week, has been appointed *assistant engineer* not assistant *manager*, to the Sunderland District Tramway Co. as stated.

General.—It is announced that Mr. Charles Bright, F.R.S.E., has been appointed consulting electrical engineer to the Australian Commonwealth Government.

Mr. W. G. Hunter has resigned his position as publicity manager to the Union Electric Co., and is now practising as a free-lance "advertising specialist," especially for electrical firms, under the title of the Adcraft Studio, at Thanet House, 231, Strand, W.C.

Mr. R. W. Weekes asks us to state that his connection with the *Electrical Engineer* as editor terminated in July last, and that he has now no further connection with, or interest in, that journal. Mr. Weekes is now devoting his time to his consulting engineering practice, which is carried on at Maxwell House, Arundel Street, Strand. We understand that he specialises in the equipment of factories with steam and electric plant. Mr. Weekes carries with him the best wishes of the Electrical Review for a full measure of success.

CITY NOTES.

British Electric Transformer Co., Ltd.

At this company's annual meeting on Monday, the chairman, Mr. J. F. Albright, in moving the adoption of the report (see Electrical Review, February 26th, page 312), after discussing the items in the accounts, said that the ordinary shareholders must be gratified that their dividend had increased from 3½ to 5 per cent. Before declaring it they carefully weighed the probabilities of maintaining such a distribution. They were looking carefully after the future as well as the present. They had made an advance in a certain direction, of which he could not give many details, during the year. They had entered into alliances in two important directions, and had still further negotiations of a somewhat similar character on foot. These alliances did not tend to the formation of a trade ring or pool, or to the inflation of prices, but while they were specific in some directions, and general in others, the objects aimed at were to see how best the makers of transformers could work together, instead of against, each other. The company were specialists of a somewhat limited size of transformer, the size being limited at the big end of the scale by the fact that in England they seldom even got inquiries for the large transformers of, say, 2,000 kw. or 3,000 kw., and 20,000 volts and upwards; they were limited at the small end of the scale also by the comparatively small demand for really small transformers. Of course, the auto-transformer business had meant a few thousand of various sizes, but to make small transformers cheaply, and thus create a demand, whether for cooking, heating or auto-transformer work, they ought to put down special plant and make by the 100 or more per diem. They were, therefore, constantly on the alert to seize any chance of broadening the basis of the business at either end of the scale, or indeed, in any other direction that might offer prospects of sound business. He had nothing definite to report, but it was just possible, by the time they met again, he might be able to tell them that they had done something towards enlarging the basis of their operations. There were no dark clouds on the horizon, and 1910, as it had begun, looked like being, at least, equal to 1909.

The report was adopted.

Metropolitan Electric Supply Co., Ltd.

The directors report that during the year ending December 31st 1909, the capital expenditure, which at the end of 1908 amounted to £1,874,559, had increased to £1,898,492, being an increase during the year of £23,862. The gross revenue for the year amounted to £174,367, as compared with £180,672 in 1908, being a decrease of £6,305. The working expenses amounted to £79,847, as compared with £80,698, being a decrease of £851. The balance at the credit of the revenue account, before providing for depreciation, is £94,520. The directors have set aside £15,000 as an addition to the depreciation and reserve fund, carrying to the credit of the net revenue account £79,520. This sum, with the balance brought forward from last account, interest and dividends on investments, and other receipts, makes a total of £92,297. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains £49,377. To this the directors have added £1,500 from the undistributed balance of the Marylebone purchase money which was set aside towards the maintenance of dividends during the development of other business to replace the loss of Marylebone. This increases the balance at the credit of the net revenue account to £50,877. An interim dividend of 2s. 6d. per share (at the rate of 5 per cent. per annum) on the ordinary share capital, amounting to £25,000, was paid on August 10th, and the directors recommend that a further dividend of 2s. 6d. per share on such shares be now paid, making a total distribution for the year of 5s. per share, or 5 per cent. This will absorb a further sum of £25,000 and leave a balance of £877 to be carried forward. The balance at the credit of the depreciation and reserve fund now amounts to £248,855. During the year new connections representing the equivalent of 43,398 8-c.p. (or 30-watt) lamps were added to the company's system, making a total connection at the end of the year of 847,702 lamps. The stations, machinery and plant have been maintained in a satisfactory condition. Agreements have been entered into with the District Councils of Hanwell and Southall-Norwood for the transfer to the company for a period of 42 years of the provisional orders granted by the Board of Trade to these Councils, and it is anticipated that a supply of energy will be available in these districts during the present year.

The meeting is to be held on Tuesday, March 8th.

Cicely Rubber Estates Co., Ltd. — The directors announce a third interim dividend of 25 per cent. on the ordinary shares and 26¼ per cent. on the preference shares.

Western Telegraph Co., Ltd.—A second quarterly interim dividend of 3s. per share has been declared for the year ending June, 1910, being at the rate of 6 per cent. per annum.

Direct Spanish Telegraph Co., Ltd.—A dividend at the rate of 4 per cent. per annum has been declared for the past half-year.

Smithfield Markets Electric Supply Co., Ltd.

Mr. Herbert S. Leon presided at the offices, 57, Charterhouse Street, E.C., on Thursday, February 24th, over the twelfth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 269), the Chairman said that on capital account they had only spent £136, and that was for new installations, which might be considered as revenue earning. As to the revenue account, it was unfortunate, but they had had a bad year. No blame, however, attached to anyone; the result was entirely owing to force of circumstances. The fact was that a new lamp had been invented which used about 70 per cent. less current than the old one, and in addition gave a better light, and naturally nearly all their customers had transferred their allegiance from the old to the new. The result was that the company had had its profits reduced almost to a vanishing point, for their revenue per lamp had fallen to 5s. 9d. per lamp, as compared with 7s. 8d. in 1908, which was a decrease of 25 per cent. It was not possible for them to compare their position with that of any other company, because they had a restricted area, and could not go outside. There were still a few shops in the market who were not supplied by the company, and they were in hopes that when they saw the results of the new lamps they would give up the old-fashioned system of gas lighting and adopt the electric light, and when next they met he hoped he would be able to tell them that the whole of the market was electrically lighted. They had no desire to take advantage of the monopoly they had and charge higher prices than other companies, but they had boldly issued a notice stating that as from January 1st of that year the prices of current would be raised to those using metallic-filament lamps. At the same time they pointed out that the prices would still be cheaper than gas, and also cheaper than the old carbon lamps. This notice created a sort of miniature revolution in the markets, and they were threatened with a boycott, but they issued an explanatory circular in which they stated that the directors did not desire to make a large profit at the expense of the tenants, but they did not intend that the business should be carried on at a loss. Since then they had heard nothing, although there might possibly be developments at quarter day. Turning to the revenue account, on the credit side there was an item of £400 written back in regard to the premium on the redemption of the £8,000 second debentures. This was only available in the event of the bonds being redeemed before maturity, and as they came due in July last it was no longer necessary to pay the £400. It was the intention of the board to pay the £8,000 second debenture bonds in the course of the next few months, and then the item of £400 would disappear from the accounts. After more than two years' patient negotiation an arrangement had been arrived at with the City Corporation to renew their old contract till 1972. The Corporation had the power of acquiring their undertaking at two dates previous to 1972, but if they acquired it before that date they had to pay a fair value for the business. If the options were not exercised, then in 1972 the business passed to the Corporation. They had had, of course, to give some *quid pro quo*, but the demands of the Corporation were not exorbitant. They obtained the concession by going straight to the Corporation and putting their case clearly and frankly before the committee and concealing nothing. They made their appeal as business men to business men, and employed no lawyers. They had a first rate case, and got what they wanted without the smallest friction, and he wished to take that opportunity of testifying to the extreme courtesy with which they were met at all times by the Markets Committee. It would be the policy of the board to put by a small sum each year to redeem the first mortgage debenture bonds on or before 1972. In conclusion, he could only express regret that they had not earned a dividend. He was not of a very sanguine disposition, but he thought at the end of the year they might hope that a new era of moderate prosperity, which meant a small dividend to shareholders, would reward those who had waited so patiently for some result.

Mr. E. Schenk seconded the motion.

Mr. Butlin congratulated the shareholders on meeting under happier circumstances, because two years back the company was practically a wreck. Now, though they could not make a fortune, still they had not lost the whole of their money. The result was due largely to the good work of the board and of Mr. G. M. Powell, the manager and secretary. Seeing that they had a reserve account of £21,000, he could not quite understand why they should not pay a dividend, although he understood that £8,000 would be applied for the redemption of the second debentures.

Mr. Huggins also congratulated the board on the result of their negotiations with the City Corporation, but considered it would be a very bad policy to tamper with the reserve.

The Chairman said the reason no dividend was paid was because they had not earned one. Most of the reserve was in the business, and they would have little cash in hand after redeeming the debentures. He considered it would be violating one of the first principles of finance if they borrowed money to pay a dividend.

The report was adopted, and the retiring director re-elected.

Telegraph Construction and Maintenance Co., Ltd.

The ordinary general meeting of this company was held on Tuesday at 38, Old Broad Street, E.C., Sir James Pender, Bart., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 313), after stating that owing to political events it had not yet been possible to fill the vacancy caused by the retirement of the chairman, said that the affairs of the company were satisfactory to them all. The debentures had been reduced by £10,000, owing to some holders having preferred to be paid off rather than renew the bonds at the end of last year. The item of debts owing by the company, and reserves for insurances and contingencies, was larger in amount than last year, owing to the fact that a sum was included for 1909 received on account of uncompleted cable work. The first item on the credit side of the balance-sheet was also larger than in 1908, on account of cable manufactured and not delivered being greater in volume than was usual. The result of the year's work was very gratifying, especially when it was remembered that all the important contracts which they had carried out had been obtained not only by tendering successfully against other British manufacturing companies, but they had also had to meet the competition of the great Continental cable-makers who were so much helped and supported by their Governments. In spite of all this, they could not complain of the amount of work which had come to their factories. They had had a very busy year; and, in face of a grinding competition and the low prices it produced, their profits had been satisfactory. They had, of course, foreseen for many years that the time would come when the bidding for work would be very keen and when prices would be closely cut, and they had been preparing for this state of things by providing themselves with the most modern appliances, and keeping down the cost of production; but, after all, the great secret of their being able to show so good a result was the strenuous work of their employés. Every department and every man appeared to be determined to break all records of previous work. At no time in the history of this company had the staff been more efficient or had a better feeling pervaded it; each in his own branch of the work had toiled for the company's good, not with indifference to personal gain, yet with determination that, above all, the company should be successful, and hold its own against all rivals.

Mr. Colin F. Campbell seconded the motion.

Mr. Croft congratulated the board upon the extremely satisfactory result of the year's working. He knew it was the wise policy of the board not to disclose too much of the particulars of the business, in view of the keen competition, but he would like to know whether the company had been invited to tender for a new cable, which, he understood, was going to be laid by the Commercial Cable Co.

The Chairman, in reply, said that so far tenders had not even been invited by the Commercial Cable Co. for the new cable they intended to lay.

The report was adopted.

Companies Struck Off the Register. — The following companies have been struck off the Register, and are accordingly dissolved:—

Adelaide Electric Tramways, Ltd.
Automatic Electric Co., Ltd.
Bettwsycoed Electric Lighting Co., Ltd.
Burmah Electric Works Syndicate, Ltd.
Cleminson Electric Lamp Attachment, Ltd.
Diamond Electric Lamp, Ltd.
Electrical and Hardware Co., Ltd.
Electrical Bleaching Co. (1904), Ltd.
Electromotion Corporation, Ltd.
Expansion Turbine Syndicate, Ltd.
Ilford Accumulators, Ltd.
Imperial Engineering Supplies Co., Ltd.
Incandescent Mill Lighting Co., Ltd.
Kno-Wet Patent Dry Seat Co., Ltd.
Manchester and Liverpool Electric Railway Syndicate, Ltd.
Perth Electric Lighting Co., Ltd.
River Po Electric and Power Syndicate, Ltd.
South American Traction Co., Ltd.
Tavistock and District Electric Supply Co., Ltd.
Wynne's Electric Closed Tube Tramways, Ltd.

Chelsea Electricity Supply Co., Ltd.—The directors' report for the year ended December 31st, 1909, states that the profit amounts to £34,702, which with £1,025 brought forward, and £757 for interest, makes a total of £36,484. After deducting interest on debenture stock £7,875, interim dividend 6 per cent. on preference shares £900, interim dividend on ordinary shares at the rate of 4 per cent. per annum £4,944, there remains £22,765. Out of this the directors recommend that there be placed to credit of renewals and depreciation fund £12,530, to credit of debenture stock premium redemption fund £704, written off cost of extinction of founders' shares £1,089, final dividend on the preference shares at the rate of 6 per cent. per annum, making 6 per cent. for the year £900, final dividend on the ordinary shares at the rate of 5 per cent. per annum, making 4½ per cent. for the year, £6,179, leaving £1,363 to carry forward. The number of 8-c.p. lamp equivalents connected on December 31st, 1909, was 261,130, an addition of 10,020 during the year, and the total number of units sold was 3,806,366, being 151,758 more than the previous year. The meeting is to be held on Wednesday, March 9th.

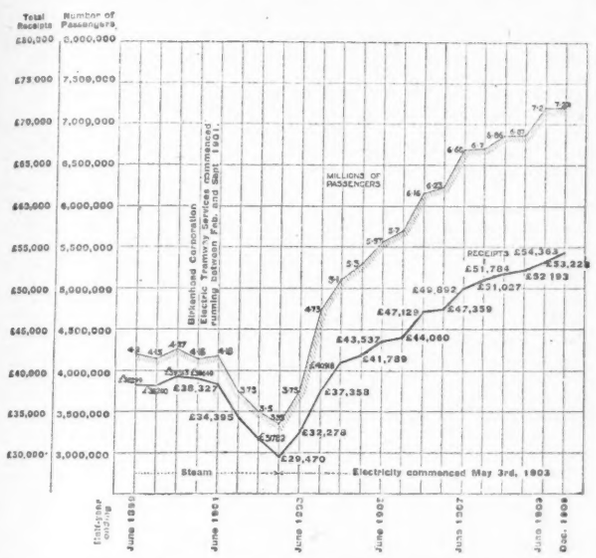
Continental.—Belgium.—The balance-sheet of the Société des Tramways Electriques du Pays de Charleroi et Extensions, of Charleroi, for the last financial year shows a profit of £6,318, as compared with £6,396 in the preceding 12 months.

France.—La Société Francaise des Cables Electriques, système Berthoud, Borel & Co., of Lyons, is declaring a dividend at the rate of 80 fr. for the last financial year, as compared with 75 fr. per share for the preceding 12 months.

Greece.—La Compagnie Hellenique d'Electricité Thomson-Houston, of Athens, is declaring a dividend of 5⅝ fr. per share for the last financial year, as compared with 5½ fr. in the preceding 12 months.

Mersey Railway Co.

The directors report that during the half-year ended December 31st, 1909, the train-mileage run was 337,506 miles as compared with 403,639 during the corresponding six months of 1908. Passengers conveyed were 5,910,603, as against 5,720,877 for the corresponding period of 1908, exclusive of season ticket holders. The total receipts from all sources have been £54,363, as compared with £52,193 for the corresponding period of 1908. The working expenses, exclusive of the charges for pumping, ventilation and lifts,



Curves Showing Mersey Railway Results During Recent Years.

have been £30,286 (55·71 per cent.), as against £33,593 (64·36 per cent.). These charges for pumping, ventilation and hydraulic lifts, amounted to £3,505 (6·44 per cent.), as compared with £4,106 (7·87 per cent.) for the corresponding period of 1908. The company are applying to Parliament for an extension for five years of the period during which the payment of interest on certain of the debenture stocks is contingent on the available net revenue of the company and the holders of each of these stocks are entitled to appoint a representative on the board and for other purposes. The Bill has already received the necessary assents of the debenture stockholders and the proprietors. The meeting is called for Tuesday, March 8th.

National Telephone Co., Ltd.

Mr. George Franklin presided on Thursday, February 24th, over the forty-fifth ordinary general of this company held at Hamilton House, Victoria Embankment.

In moving the adoption of the report (see Electrical Review, page 270), the Chairman said that the accounts continued to show steady progress, increased revenue, and larger balances for disposal. The income in respect of the business for the half-year showed an increase of £101,559, having increased from £1,498,431 to £1,599,990. The Post Office royalties were £153,867 as compared with £144,226, making a grand total which had been paid to the Postmaster-General, for which they had received no services whatever in return, of something like £3,200,000 since the commencement of the business. The working expenses had increased from £858,566 to £922 693. They had a net result for the half-year of £523,440 as against £495,638, or an increase of £27,801. That sum had been disposed of by the increased debenture and other interests, £15,000 to reserve, which now stood at £170,000, and the increase in the balance carried forward. Rents of premises, rates, taxes and insurance amounted to £122,566 as compared with £111,049 for the corresponding period last year. The administration and management expenses were £376,618, as compared with £365,587; maintenance and renewals of lines and instruments and depreciation allowances were £338,606 compared with £322,075. The rent and maintenance of Post Office wires was £51,253, while Parliamentary expenses made up the rest of the increases for the half-year of £64,127 in expenses. Dealing with the whole year of 1909 the total income amounted to £3,149,126 as compared with £2,951,000, an increase of £198,126. The Post Office royalties showed an increase of £19,226; working expenses had increased £125,956, and the net result was an increase of £52,944. During the period of the accounts under review, £255,361, as compared with £361,079, had been expended on the construction of exchange and private stations. The diminution was entirely due to the restriction which the directors were exercising on capital expenditure in view of the approaching termination of the licence. Referring to the capital expenditure account, it would be seen that £14,972,793, or £29 14s. 7d. per station, had been spent in acquiring undertakings and erecting stations. That compared with an average cost per station of £53 or £54 erected by the Postmaster-General in London and the provinces. If they added the amount expended on lands and buildings—£850,197—they had a total of £15,822,990 expended upon the company's business, of which during the past six years something approximating to £6,000,000 had been spent, therefore showing they had met the requirements of the public. They had raised £11,483,593 in stocks and shares, including debenture stock, leaving an excess of expenditure over capital raised of £4,339,397. He was sometimes asked how that balance had been provided, and he would point out that the amount received as subscriptions in advance—£1,196,318—they were not entitled to take into the revenue account for the period for which they were paid in advance; and they had a reserve fund of £3,290,908, which more than covered the balance on the other side. During the half-year 13,896 additional private stations and exchanges had been erected, of which 13,443 had been upon the measured rate, making a total of 503,643 stations. Since December 31st, 1908, the company had increased its lead on the Post Office stations by 1,249—the number actually possessed by the Postmaster-General being 60,091, as compared with the company's 112,205. The unexecuted orders on December 31st were 5,435, representing £36,229 per annum, as compared with 5,220, representing £34,334 at the end of 1908. These results had not been achieved by any sacrifice of efficiency. That there was a marked improvement in the readiness and rapidity of communication was proved by the fact that in London during the past four years there had been a diminution in the complaints of something like 40 per cent. in number. The chairman then proceeded to deal at length with the statement made by the Postmaster-General, to which he (the speaker) referred at the last meeting, that an earlier purchase of the company's property, assets and plant, than that provided in the 1905 agreement was, from the point of view of the public, advisable. In view of the possible contingency that the question of what price should be paid for the undertaking might have to be settled by arbitration, the board and the staff had, he said, for some time past, been engaged in the preparation of the necessary work for making an inventory of the company's plant. That would enable the company to prefer a claim at as early a date as was possible after the termination of its licence. The arbitration authority agreed to was the Railway and Canal Commission, and by an Act of Parliament, which received the Royal Assent last October, that body had been clothed with power to undertake the work which the agreement committed to them. The board would take care that the claim—if it had to be made before an Arbitration Tribunal—was properly made, and at all events that the shareholders' interests would not be neglected.

Mr. S. H. Sands seconded the motion.

Replying to a question by a Shareholder, the Chairman said the agreement provided that from December 31st, 1911, the Postmaster-General was to pay interest at the rate of 3 per cent. on the purchase money until it had been paid. It was quite clear it would be *ultra vires* to pay a dividend after 1911.

The report was adopted.

Oxford Electric Co., Ltd.

The directors' report, which is to be submitted to the meeting at Oxford to-day, states that, for the year ended December 31st, 1909, the revenue account shows a profit (including £1,203 brought forward) of £15,012. After providing £2,142 for debenture, other interest, and discount on preference share instalments paid in advance, also writing off £917 on account of hire-purchase installations, the balance available for dividend is £11,953. The directors propose a dividend at the rate of 7 per cent. per annum on the ordinary share capital (whereof 2½ per cent. was paid in September last), £7,000; a dividend at the rate of 5 per cent. per annum on the preference share capital ranking therefor (whereof 2½ per cent. was paid in September last), £1,375; placing to credit of reserve and renewal of plant account, £2,637; carrying forward £940. Reserve and renewal of plant account has been charged with the cost of plant replaced. It is estimated that at December 31st last there was the equivalent of over 115,379 8-c.p. lamps connected to the mains. The lamp and motive power connections have been greater than the average of previous years, and notwithstanding the increased use of metallic-filament lamps, the revenue has exceeded that of the preceding year. The plant has been maintained in thoroughly efficient order. The distributing network of mains in the north and central districts has been remodelled and increased in capacity. The supply mains of the company have been extended in the Banbury, Blackhall, Cowley, Parks and Woodstock Roads, and in Walton Street.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in:—

Rosario Electric Co.—20,000 ordinary shares of £5 each, £1 paid, Nos. 32,001 to 52,000.

And to allow the following securities to be quoted in the Official List:—

Rosario Electric Co.—20,000 ordinary shares of £5 each, £1 paid, Nos. 32,001 to 52,000; and 18,951 ordinary shares of £5 each, fully paid, Nos. 1 to 18,951. (Special application.)

Straits Settlements (Bertam) Rubber Co.—An interim dividend at the rate of 15 per cent. per annum is announced

Newcastle-on-Tyne Electric Supply Co.—The directors recommend a dividend of 4 per cent. for the year on the ordinary shares, after transferring £16,500 for depreciation.

London Electric Supply Corporation, Ltd.

The ordinary general meeting of the shareholders of this company was held on Friday at Winchester House, Old Broad Street, the Earl of Crawford presiding.

Mr. Robert H. Benson proposed the adoption of the report (see Electrical Review, page 315). He said that last year they were congratulating themselves on the improved outlook for the electrical industry in London, and for their own company in particular, in consequence of the passing of the Act of Parliament on December 21st, 1908. They had further grounds for self-congratulation in the contract they had entered into with the L.B. and South Coast Railway to supply power for the electrification of their line between London Bridge and Victoria. If they were justified then in feeling sanguine, they had more cause to be so to-day. Though the improvement in the prospects of the company had come slowly, it had come surely, and they thought that the foundation was now securely laid. The present accounts might be said to deal with ancient history as they dealt with a period of transition during which their old customer, the L.C.C., was taking less and less current, and their new large consumer, the L.B. and South Coast Railway had hardly begun. There was, however, an essential difference between the two customers—the one was a temporary customer and was always known to be so; the other, they believed, would be a lasting one. They had sold nearly three million fewer units last year, but the net revenue only showed a decline of £2,500. After paying the usual 6 per cent. on the preference shares, they proposed to appropriate £6,660 in paying 2 per cent. on the ordinary shares, and to add £5,000 to the reserve, making that fund £67,500, or 20·27 per cent. of the ordinary share capital, without counting the £10,000 additional which had been credited to contingencies. The amount of power supplied to consumers, other than the L.C.C., was more than 13 times what it was six years ago, and was still in its infancy. Last year nearly one-half of the units sold were for power purposes, and the railway demand had yet to come in. They were not under-rating the lighting demand, but the power demand might increase for the next few years on a very large scale. There were two points he would like to refer to which ought to have a marked influence on the prosperity of the company in the future—the permission granted under the Act of Parliament for companies to work together and the further development of railway traction south of the Thames. Within a few weeks of their last meeting they opened negotiations with two of the principal companies in their area, and an agreement had been come to, which only awaited the sanction of the Board of Trade. Such an agreement would be of immense advantage to all parties concerned, including the consumer. It meant that instead of duplicating mains, laying down fresh plant and causing general inconvenience by breaking up the streets, the companies concerned had laid their heads together to find out how the existing mains might be most economically used for the supply of both direct and alternating current. Up to the passing of the 1908 Act such combination was illegal, and it was no exaggeration to say that half-a-million sterling, for which the public would eventually have paid, had been saved by this agreement, without detriment either to the consumer or to the public. As to the Brighton Railway, the running of trains by electricity was delayed until December 1st, so that their earnings from that source were less than they had anticipated, and they failed to compensate them for the decreasing amount of current sold to the L.C.C. They confidently anticipated that the increased demands from the Brighton Co. this year would more than make up for the decrease from the L.C.C., in fact, if only the present demand of the railway company was maintained, they ought to sell them alone more than 5 million units this year. If, as the chairman of the company hinted, they decided to extend the electrification of their suburban traffic without delay, they might see their way to enter into a long contract with them to supply four or five times the present amount of current, and the more they supplied, the cheaper they could produce it. They might fairly regard themselves as being on the way to become the largest purveyors of electricity for power purposes in the south of England. They had the plant for a very much larger output; they had the site for a still greater extension, and last, but not least, they had a staff which, for fidelity, experience, efficiency and economy it would be difficult to match. The company had good financial friends, and it was never likely to be hampered by want of capital, even to the extent of supplying 50 million units, if they judged it to be to their interests to do so. In conclusion, he said that in the opinion of the directors, the political and commercial risks of their undertakings were now at an end, and that they might congratulate themselves on the near prospect of fruition for their outlay, and a reward for their past sacrifices.

Mr. R. Stewart Bain, the managing director, in seconding the motion, said that the capital expenditure last year amounted to £17,174, the principal items being £5,779 for plant and machinery, £7,071 for mains, and £2,060 for electrical instruments. The first item included a 600-kw. rotary converter, by means of which they could supply direct current from their alternating machines, which was both convenient and economical in connection with their power supply. The expenditure on mains included the laying of 2½ miles of new mains, principally along the south side of the river in connection with the supply of power and light to the Royal Victualling Yard, and the cattle markets at Deptford. They had just secured another important contract in the same district—the supply of power and light to the Port of London Authority in connection with the Surrey Commercial Docks. The amount for electrical instruments included the cost of the new switchboard for the railway supply. The units sold were 2,800,000 less than last year. The contract for the supply of power to the L.C.C. expired in June, and as they took 5½ million units in 1908 and only one million last year, there was a decrease there alone of about 4½ million units and of £16,150 in revenue. On the other hand, owing to the contract with the Brighton Railway Co. and the steady increase in their power supply, they had increased their revenue to the extent of £7,846, and by means of economical working, regarding which he could not speak too highly of their engineering staff under Mr. Partridge, they saved £5,789. Those two items amounted to £13,635, which, deducted from £16,158, left a net decrease of only £2,500. They would have more than made up the loss from the L.C.C. had the Brighton Railway commenced the running of their trains in July. During the year they had connected more lights than ever before in any single year, but owing to the continued installation of metallic-filament lamps the increase in lighting units was almost stationary, showing the small increase of 53,000 units. Before the introduction of metallic-filament lamps the increase of lamps for last year would have meant an increase in lighting units of no less than 780,000. It would appear, therefore, that the yearly increase of lamps about neutralised the decreased consumption caused by the introduction of the new lamps. A pleasing feature was the reduction in the works cost from £34,724 last year to £28,329, or a saving of £6,395. Owing to that saving, the works cost, in spite of the reduction of nearly 3 millions in the units sold, was ·66d. as compared with ·63d. last year, and but for that saving the cost per unit sold would have been ·80d., or a difference of over 20 per cent. Of the total units sold 46 per cent. was for power. The rate per unit sold still continued to show a reduction, but they were keeping pace with that in the reduced cost of production. Last year was the first since 1904 that they had been free from the waste of time and money in connection with Parliamentary opposition. If the 1908 Act had done nothing else, it would have been very valuable, but he was glad to say the companies and municipalities were co-operating to give practical effect to the clauses in the Act which enabled electric supply undertakings to associate for mutual benefit.

Mr. Makins remarked that the present condition of the company must be very satisfactory to all the shareholders. He noticed, however, that the capital account was overdrawn by nearly £142,000. Mr. Benson had told them that the company had good friends who would finance it, but he (Mr. Makins) thought it would be better to give the shareholders an opportunity of finding that money.

Mr. Hankey said he thought it would be a mistake to issue preference shares at the present time. Undoubtedly in a few years' time the board would be able to issue them much cheaper than they could now.

Mr. Benson, in reply, said the board took the same view as Mr. Hankey. They had a good article to sell, and they did not want to sell it too cheaply. The company was not in debt to the extent of £140,000, or anything like it. That amount represented the overdraft, but from that they had to deduct their savings from income in the reserve account, which made a big difference.

The report was then adopted.

Newcastle and District Electric Lighting Co., Ltd.

The annual meeting was held at the Station Hotel, Newcastle, on February 25th, Mr. J. B. Simpson presiding. In moving the adoption of the report (see Electrical Review, page 313), he said it was satisfactory to observe that although the trade of the district had been far from good during the year, the output of electrical energy had increased by over 18 per cent., and the company's profits had been increased by about £4,000, and that had enabled them to increase the dividend. The increase had been largely due to the demand for electrical energy for power purposes, which had given a better day load, and in part made up for the drop in the revenue due to the more general use of high-efficiency metal-filament lamps. The public, however, were appreciating the lower lighting costs, and the company considerably added to the number of consumers. There was also a growing demand due to the more extended use of electricity in the home for various domestic purposes, which was being pushed as improved designs of apparatus were put upon the market. A pleasing feature in the balance-sheet was the improvement shown at Newburn, which was chiefly owing to the increased demand at Messrs. Spencers' works, and with improved trade there should result a good profit from the Newburn undertaking. The cost of coal was an important matter to the company, and the directors would like to point out that in the present unsettled state of the mining industry, it was difficult to say how far the price of coal might become affected, the directors had, however, made satisfactory arrangements for the present year.

Mr. Arthur Scholefield seconded the resolution, and it was carried unanimously.

A resolution declaring 3 per cent. dividend was agreed to.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends on the 7 per cent. cumulative first preference and 6 per cent. cumulative second preference shares for the half-year ended December 31st, 1909, have been posted.

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. John Winkworth (Chairman) presided at Winchester House, Old Broad Street, E.C., on Monday over the ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 315), said that the number of new orders had been maintained. The increase for the year was 267, as compared with 266 for last year. The total number of consumers connected at the end of the year was 3,916. The total lamp connections at the end of the year amounted to 191,302, an increase of 13,675 for the year, and although this figure appeared to be a little less than for previous years, the increase in new business obtained really showed an improvement, as previous calculations were made for carbon lamps. The 35-watt carbon lamp gave a light of 8 c.p., whereas the 30-watt metal-filament lamp gave a light of 25 c.p. Consequently, the number of 35-watt equivalents on an installation of metal lamps was appreciably less than for carbon lamps. For instance, their Model House at Hither Green was lighted by 15 lamps, varying from 12 to 25 c.p., and worked out at the equivalent of 8·4 lamps (35-watt). A similar installation of carbon lamps would have represented the equivalent of about 20 8-c.p. lamps (35-watt). With carbon lamps, however, the electric light was frequently only installed in the principal rooms. With metal-filament lamps it was generally installed throughout, as, when everything was taken into consideration, the electric light was found to be cheaper than gas. A great many old installations had been changed from carbon lamps to metal-filament lamps, and from time to time the installation register was revised, but these revisions had not been given effect to in the tabulated figures in the report, as it was proposed to later on revise the standard 35-watt lamp to a more suitable equivalent. The total units sold amounted to 3,611,839, as compared with 3,303,827 for last year, an increase of about 10 per cent., notwithstanding the reduced sales for lighting owing to the use of more economical lamps. The average price received for the year worked out at 2·59d. per unit, as compared with 2·88d. for last year, a decrease of about 10 per cent., which was due to the larger proportion of units sold for power purposes. The gross revenue from the sale of electricity was £39,010, as compared with £39,595 in 1908, a decrease of about 1½ per cent. The sales for power purposes produced an increased revenue of about £1,700, and the new business for lighting about £2,500, making together the sum of £4,200, which represented the normal increase of the business for the year. The whole of this increase, with the above-mentioned £585 in addition, had, however, been absorbed by the great saving to consumers of electricity by the increasing use of metal lamps. From figures which had been got out it would appear that about 75 per cent. of their shopkeepers and about 60 per cent. of their private home customers were now using metal-filament lamps more or less, and it was a gratifying feature that their sales to shopkeepers, who were the first to use the new lamps on a large scale, and who effected a saving of somewhere between £2,500 and £3,000 in 1908, had this year shown a small increase, so that, with the aid of the new business, they appeared to have overtaken the loss of revenue from this source, and during the present, or, at any rate, next year, they hoped to also overtake the loss of revenue from private-house consumers. On the other hand, the cost of production had been reduced from 1·161. to 1·09d. per unit sold, a decrease of ·07d. per cent. Nothwithstanding the increase of units sold, there was a substantial reduction in the coal bill from £6,360 to £5,572, a saving of about 12 per cent. (part of which was due to reduction in price and part due to the economical working of the new power house. There had been a small increase in repairs, rent, rates, taxes, &c., and the expenditure included an item of £553 for development expenses in connection with the steps taken to popularise the light with the occupiers of the smaller houses in the district, and to develop the more general use of electricity for other domestic purposes. The total expenditure amounted to £16,465, an increase of £487. The directors regretted that the net balance would not permit of the payment of a dividend on the ordinary shares. The expenditure on capital account for the year amounted to £18,332, of which about £8,500 was the final payment in respect of the new power house, and the balance had been expended on new mains, transformers, meters and other services. If they deducted the amount of £6,500 (less £730 written off for renewal of meters) set aside for depreciation for the year, and making the total amount of this account £30,617, the net increase for the year was £12,562, and made the total amount expended on capital account, less depreciation, £540,913. The directors hoped, with an increase of revenue, to be able to strengthen the company by increasing the sum set aside for depreciation to a figure which would provide the capital necessary for the ordinary development of the undertaking. During the year £50,000 6 per cent. cumulative second preference shares of £1 each, and a further £15,480 debenture stock, were issued, which had enabled them to clear off the bankers' loan and other liabilities which figured in the accounts for last year, and the present financial position of the company was a strong one. During the year energetic steps had been taken to secure new business. A development committee had been appointed, which met every week, extra canvassers had been engaged, a large amount of literature had been distributed, and two model houses had been opened, one at Hither Green and one at Catford. The chairman dealt at some length on the fitting up of the model houses, and said, that although results were not apparent in the year's accounts, still new orders had shown a continuous improvement during the year. Continuing, he said that some time ago applications were made by the Royal Naval Schools at Mottingham and a number of residents for a supply of electricity, but they were just outside the area. To meet the demand the West Kent Electric Co. was registered and obtained the transfer of certain powers of the Kent Electric Power Co. for an area between Northfleet, Sevenoaks and London. The company had made arrangements to work the undertaking and to subscribe £10,000 of the share capital. Mains were about to be laid in part of the Bromley Rural District, where a good many orders had been obtained. The West Kent Co. was not subject to purchase under the terms of the Electric Lighting Act, and the business was one which might become very valuable in the future. In conclusion, he said he might safely say the foundation of the undertaking was more secure than it had ever been before, and with patience they would within a reasonable period be able to build up a thoroughly sound and remunerative business.

Mr. H. W. Bowden (managing director), in seconding the motion, said a most determined campaign had been organised and pursued for several months in the face of the most active competition of the keenest gas company in London, and the results, although small, must be regarded as encouraging. In the past, orders were secured by the wiring contractors, but now they had to be obtained at the expense of the company, by having a fully equipped and energetic canvassing staff, and it was only to be expected, therefore, that the company should endeavour to recoup itself by doing the wiring and fittings, and this was being done, and in addition they had a sales department for carbons, fittings, &c. Further economies had been effected in the operating costs, and he thought they might now take it that their generating costs were probably as low as they might expect to get them without a corresponding improvement in the load factor. Their total costs were 1·09, against 1·16 in 1908; works cost ·63, against ·715; coal per unit sold ·37, against ·462; and coal per unit generated ·246, against ·297, or slightly less than ¼d. per unit. In other words, there was a saving of £788, with an increased output of over 300,000 units. The maximum load had been increased from 2,520 to 3,075 kw.

Mr. Clark asked if the directors contemplated issuing any further debentures.

Mr. Makins inquired as to what preliminary expenses were still outstanding, and also as to how cooking by electricity compared with cooking by gas from the economical point of view.

The Chairman said they did not propose to issue any more stock unless it was for the purpose of laying new mains which would be remunerative. Preliminary expenses had been added to during the year owing to the issue of the 6 per cent. second preference shares. The item now stood at £6,424. Their tenant at Bromley Road said the cost of cooking by electricity compared very favourably with cooking by other means. It required to be conducted with care to produce the best results, but great improvements were being made in this direction. Heating by electricity certainly compared most favourably.

Mr. Makins said it seemed to him that electric companies if they would be successful in getting the business referred to must have one rate for the consumer. He would personally like electric radiators, but in Kensington he would have to have his house wired again and pay 8d. per unit.

The Chairman said of course at 8d. per unit it was out of the question. In their district any private house consumer could come in on a dead rent or could put his own service in and pay 1½d. a unit. He had put heating apparatus in his own house which cost him about £7, and he paid 1½d. per unit.

Mr. Makins: You are very much in advance of the Kensington Co.

The report was adopted, and the retiring directors re-elected.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held at the Town Hall, Northampton, on Thursday last week, Alderman F. H. Thornton, J.P., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, February 25th), expressed gratification that the extensions foreshadowed at the last annual meeting, had been so satisfactorily carried out. They had increased the amount of their building by £2,494, and of their machinery by £10,766. The manner in which the extra capital required for the extensions, over £10,000, was subscribed, was proof of the confidence felt in the soundness of the undertaking. In view of increasing business, the directors might have to make provision for increased storage capacity. This would mean an expenditure of several thousands of pounds, and necessitate a further call on the shareholders. However, in view of the company's success in the past in this direction, and the fact that the improvement would mean greater economy, and, therefore, larger dividends, he was sure that the shareholders would feel that there was justification for the expenditure. The directors proposed the increased dividend with considerable confidence, because the company's business had increased during the commencement of 1910 as it had in 1909, and they felt confident that they would be able to recommend similar dividends in future.

The report was adopted, Mr. Thornton was re-elected chairman of the board of directors, and it was decided to increase the directors' remuneration from £210 to £250.

Mirrlees Watson Co., Ltd.—The report states that the amount at the credit of profit and loss account for the year to December 31st, including balance brought forward, is £20,052. The directors recommend that £9,375 be applied in payment of a dividend of 7½ per cent., £5,000 being transferred to a new tools account, and £4,000 to general reserve account, leaving £1,677 to carry forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The ordinary general meeting of the shareholders of the above company was held on Tuesday at the offices, 148, Brompton Road, Col. R. E. Crompton, C.B., in the chair.

In proposing the adoption of the report (see Electrical Review, page 315), the Chairman said that, as compared with the previous year, the board believed that the position both as regarded the present and future output and prices to be obtained was, on the whole, a satisfactory one. They had only now fully realised the loss of output due to Messrs. Harrods having put in their own plant; this taken by itself amounted to a quarter of a million units, but they had by other means, and by making known to the public in the district the advantages of electricity for other uses, during this year made up two-thirds of this loss, so that this year only showed about 100,000 units less than last—that is to say, that their total sale, which was 5,727,000 in 1908, was 5,628,000 last year. The year had been an anxious one for the board and for the staff. They had before them the necessity for recovering the output, and they were debarred from any substantial increase in price per unit. They had made certain modifications in the discounts allowed to some classes of consumers, with the net result that their price had gone up about $\frac{1}{100}$th of a penny—from 3·14d. to 3·16d. They had, therefore, received a gross revenue of £75,506, as against £76,406 last year, so that the revenue had been reduced by £890, but, on the other hand, he was glad to report that they had succeeded in reducing the working expenses by approximately £1,900, although they had had some unexpected and heavy items to meet, and had put the usual substantial sum to the depreciation or renewal fund. The result had been that the net revenue properly attributable to this year's working was improved by the sum of £1,031. The chief cause of their satisfactory working was due to the good management at Wood Lane, at which station they were the predominant partner. There they had very largely cut down the cost of generation, and by means of which he—an engineer chairman—was very proud, and these reductions of Wood Lane costs would have been more considerable, if it had not been for the utter financial failure of the White City Exhibition, so that they might just as well have been without any contract for the electrical supply to that Exhibition. They believed, however, that this year they would receive benefit from that supply, and that consequently the Wood Lane figures would continue to be satisfactory to them. The charge for repairs and maintenance of meters was nearly £500 higher than in the previous year. Meters were always a source of expense and anxiety, and they had thought it prudent to be on the safe side and to spend sufficient money on them to keep this item of their plant in a thoroughly healthy condition. The item for rates and taxes was a heavy burden on them, and although this year it showed a small diminution of £320, yet they had not yet obtained the very substantial reduction which they had been hoping for for years past, and to which he considered the company was justly entitled. They had carried to the credit of the depreciation and renewal fund almost identically the same sum as in the previous year, after having deducted, in the usual manner, the amount spent on maintenance, and the credit balance of the fund now amounted to the substantial figure of £85,464, as against £78,196 in the previous year. The shareholders were aware that when the change in electrical pressure was made several years ago all over London, from 100 volts house distribution to the double pressure of 200 volts, it was with the main object of correspondingly doubling the pressure in the outer mains, and hence reducing the losses and reducing the necessity for future heavy expenditure in copper in the mains. For various reasons, although they had been at the expense of preparing for this change and were now ready in all respects to complete it, they had been unable to do it and to obtain the advantages of it purely on account of the opposition of certain users, who, having had their houses originally wired for the 100-volt system, could not be tempted to make the change unless the company bore a very large proportion of the cost of so doing, in other cases the objection arising purely out of inconvenience, or that they did not like their houses and decorations being interfered with by the electrical wiremen. The number of these consumers was now very small, and the board believed that they would very shortly be able to reap the full advantage of the change, the expense of which had already been almost entirely paid for out of revenue. The directors hoped that the shareholders appreciated that the company, although it had suffered from loss of turnover and from a change in the character of the district, a large number of houses attached to the system being empty, had been able to maintain a fair rate of dividend, mainly due to the economical handling of the company's capital. The capital expenditure measured in proportion to its turnover was lower than that of any other company in London, with one exception, that of the company which supplied the central district where the theatres were concentrated. It was due to this economical use of capital in these difficult times that the distribution of dividends had been kept fairly high. The nature of the district, in common with other residential parts of London, was changed. Houses previously occupied by residents had been let off as private hotels, some were sub-divided into flats, or new flats were being built in place of the private residences. No one could say whether this would act prejudicially on their future output or not. The board thought there was not much fear of any considerable reduction, but the shortness of tenure of many of the tenants had introduced considerable anxieties and extra difficulties in collecting their revenue, and part of the increased legal charge was due to this. Summarising the year, he might say that the board considered they were justified in pointing out to their shareholders that the position of their undertaking was an extremely good one. The plant was in good order; practically the whole of the old-fashioned plant having been written off. The plant that they now used and which was carried on their books was working economically, and as had been uniformly the case in the past, the staff of the company had given excellent services, and he hoped that the shareholders thoroughly appreciated this.

Mr. R. W. Wallace, K.C., seconded the motion, and the report was adopted.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The directors' report for the year to November 30th, 1909, states that the profit, after providing for operating and administration expenses and interest on loans, amounts to £4,436, plus £318 brought forward. Adding £432 damages for delay in delivery of rolling stock, there is £5,186. Part of this balance has been applied as follows: In writing off costs of action with Llandudno Urban District Council £744, in placing to depreciation reserve account £750, and in writing off expenses of loans £500, leaving a balance of £3,191, which the directors recommend should be applied as to £2,982 in payment of a dividend in respect of the year ending November 30th, 1909, at the rate of 3 per cent. upon the issued capital, carrying forward £209. The traffic receipts show an increase of £2,204 on the receipts for the previous year. The receipts were adversely affected by the bad weather which prevailed during the summer months, and by the delay in the completion of the additional rolling stock. The facilities for traffic on the line have been increased by the addition of four new cars, which are giving satisfactory results. The extension to Old Colwyn is still under consideration. The directors are of opinion that, provided the expenditure with regard to road widenings is kept within reasonable limits, it should prove a valuable addition to the company's system. It is hoped that a satisfactory settlement of the question will shortly be effected. The action brought by the Llandudno U.D.C. against the company with regard to questions arising out of the agreement for supply of power was, on the advice of counsel, compromised on November 13th, 1909. As a term of the compromise the Council agreed to forego their claim for increased price of current up to that date, and further agreed, when called upon by the company, to take a poll by ballot of the ratepayers within their district, to determine whether permission shall be given for Sunday running. Mr. Stephen Sellon, having accepted the position of consulting engineer to the company, has resigned his position of chairman, while retaining his seat on the board. Mr. A. W. Tait has been appointed chairman.

Route miles constructed	6·6
Car miles run	247,483
Passengers carried	1,356,323
Passengers carried per car-mile	5·47
Traffic revenue per car-mile	13·82d.
Average fare per passenger	2·53d.
Expense ratio	57·67 %
Number of cars	18

At the meeting held on Monday at Winchester House, Mr. A. W. Tait in proposing the adoption of the above report, said the traffic receipts amounted to £14,272, as against £12,067, an increase of £2,204. He could not say that that was to be regarded as a satisfactory increase in view of the fact that in the previous year only a part of the line was opened, and also that a considerable part of the increase was in the first part of the year. The disappointment of the board with regard to the traffic receipts was due in a large measure to the bad season which they had had, for, as they knew, the company was dependent in a great measure on the summer holiday traffic. The receipts were also affected by the fact that the new rolling stock which they had hoped to have had to relieve the traffic during August, was not completed. This was not due to any want of forethought on the part of the board, but because the contractors got into difficulties, and delay ensued before the cars were ready. With regard to the profit and loss account, the only items on the debit side which were affected, were traffic expenses and repairs and maintenance. The traffic expenses had naturally increased owing to the additional service, because the company had practically run 60,000 more car-miles than in the previous year. Repairs and maintenance were also naturally heavier, because, in the previous year, the equipment was new, and very little came in on that account. The extension to Old Colwyn, which they had hoped would have been proceeded with by this time, was still under consideration. The directors had had several meetings with the Colwyn Bay Council with a view to arriving at a settlement of the amount which would be required for road widenings in connection with the extension of the line, and as they were unable to arrive at an agreement, it was necessary to remit the matter to the Light Railway Commissioners. That body held an inquiry on December 18th, and at the present moment the Board had before the Colwyn Bay Council an offer with regard to the subject, but they had not yet heard whether it would be accepted. He could assure shareholders that unless the Colwyn Bay Council could restrict their demands on the subject of widenings to approximately the amount which the company had offered, there was very little prospect of the extension being proceeded with, because it would so load the capital of the company that the extension would not be a profitable one—at least, at the outset. The next matter he would draw attention to was the settlement of the action with the Llandudno U.D.C. It was a suit brought by the Urban District Council in connection with the interpretation of an agreement with regard to power supply. In the agreement there was a sliding scale in respect of the units taken by the company, and there was a dispute as to whether that sliding scale

was operative annually, or only with regard to the first units taken by the company. The board were advised by counsel that they had a very good case for resisting the demand of the U.D.C. that the scale was to be applied annually, and it was only after getting up further evidence that they found in the original negotiations it had been more or less agreed to on the basis of an annual sliding scale; and it was therefore necessary to arrive at a settlement with the Council. That had been effected, and under the terms of the settlement the Urban District Council agreed to forego their claim in respect of additional price of current up to that date, on the understanding that the company made a contribution towards their legal expenses in connection with the action. On the other hand, the U.D.C. gave the company the right to demand a poll of the ratepayers with regard to Sunday running of the cars, such poll, however, to be taken between November and March, and no second poll to be taken sooner than three years after the first.

Mr S. Sellon seconded the motion, and the report was adopted without discussion.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The third annual general meeting was held on Monday, at Newcastle-upon-Tyne, Mr. J. B. Simpson presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 315), said that the public response to their invitation was gratifying, as the whole amount of new capital, which was offered, £65,000, was subscribed for. The issued and paid up capital was now £150,000. 176 new shareholders joined the company, representing persons in all parts of the country and of all classes, and the total number of shareholders was now 241. They proposed to ask the meeting to further increase the authorised capital, but they did not propose at the present time to make any further public issue; in fact, they did not propose to make any issue at all except 10,000 shares to the Weardale Steel, Coal and Coke Co., Ltd., which they undertook to allot to them when entering into an agreement with them three years ago, for the erection of this company's first generating station. These shares would be issued at par, and paid for in cash. They would not, of course, require to issue any further capital until they had made some new agreements for additional generating stations. Some negotiations were in hand with this object in view, but it would be some little time before they were brought to a conclusion, or at any rate before any further capital was required to carry them out. The results of the year had been very satisfactory. The profits earned were £16,731. This was in spite of the fact that one of the smaller generating stations, which it was expected would be running continuously several months ago, was not yet doing so, so that some of the revenue which they expected to get last year had not yet been earned. They hoped, however, that this station would soon be running satisfactorily, and that the coming year would benefit considerably thereby. The other generating stations had run very satisfactorily throughout the whole year, and had quite come up to the results expected. They were writing off and transferring to the reserve a total amount of £4,865; it was their intention to make regularly every year a proper reserve out of profits for depreciation and other purposes. They had taken up shares at par of a value of £19,996, which was approximately one half of the share capital, in the Bankfoot Power Co., Ltd., which owned the generating station for utilising waste heat at Bankfoot, in County Durham. The other half of the capital was held by Messrs. Pease & Partners, Ltd., who supplied the waste heat from their coke-ovens. They had every confidence that this investment would yield a satisfactory return in the form of dividend. It was now amply proved, and appreciated by those who had agreements with them that without such a company as this and without the electric power companies, it was not possible for the owners of waste heat to use their waste heat economically or to make anything like the same profit out of it.

The report was adopted, a 7 per cent. dividend being approved. An increase of £100,000 in the nominal capital was agreed to.

Notting Hill Electric Lighting Co., Ltd.

The twentieth annual meeting of this company was held on Tuesday at Winchester House, E.C., Sir William Crookes, F.R.S., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 314), said his pleasure was enhanced on this occasion as the profit of the year's working constituted a record in the history of the company, and he was able to justify the hope he expressed at the last meeting that it might be possible on this occasion to recommend an increased dividend. The capital expenditure during the year had increased by £3,709, of which £3,677 was spent on new mains and meters. That expenditure was to pick up new consumers, and the board were always careful to ascertain that the revenue on an extension of the mains would be such as to justify them in making the outlay. The revenue account must be acknowledged to be eminently satisfactory. Nothwithstanding the fact that they sold nearly 80,000 more units, the expenditure had decreased in almost every instance and showed a saving on the year of £400, whereas the revenue showed an increase of nearly £1,000, and for those excellent results their thanks were due in a great measure to their head staff. After increasing the depreciation fund from £2,300 to £3,000, and allowing for payment of interest and the Wood Lane sinking funds, there was a balance of £11,608 on the profit and loss account. The depreciation, renewal and reserve fund account was now brought up to a total of £32,746, and it was a matter for congratulation that that account accumulated year by year without it having been necessary for them up to the present to trench upon it for any unusual expenditure on renewals. Their rule was to pay for all renewals and repairs out of revenue. The Kensington and Notting Hill joint debenture stock sinking fund showed that this company had now contributed over £10,000 to the fund. As a matter of fact, their proportion was very much in excess of that figure, as the fund was invested in trustee securities, and the interest was compounded. The statement of electricity generated showed that they sold over two million units to private consumers. At the last meeting he predicted that the metallic-filament lamp which was being now so largely adopted on account of its efficiency, using as it did less than half the current of the old lamps, might lead to the company suffering from a decrease in the quantity of current sold. It was very gratifying, however, to find that up to the present this had not been the case, owing to the extension of their business having more than counteracted the smaller consumption of current by the old customers; but it might be that the result of the new lamp was to induce consumers to use more light and make their homes brighter, without increase of cost. During the year they had added to their mains another 175 customers, comprising 12,000 additional lamps. The Wood Lane works were running extremely well, and they were turning out current very cheaply, and he saw no reason why they should not continue to do so. The contract which they had for supplying the Exhibition did not turn out quite so remunerative as they expected, owing to the non-success of the Exhibition and a consequent drop in the quantity of current taken. A new contract had been entered into to give a supply to the Japan-British Exhibition this year, and there appeared to be many indications that it would be a great success. In contrast to the practice of recent years, there had been no Bills brought before Parliament to harass the electrical industry. The only Bill which was introduced, and which was not passed owing to pressure of Parliamentary business, was one brought in by the Board of Trade to make the L.C.C. the purchasing authority of the West End companies, including their own, instead of the local borough councils. It was being introduced again this session, and the directors saw no reason for opposing it. By the Act, passed in 1908, the companies had power to combine and to make working agreements with one another, and the directors had under consideration arrangements which might be made in that direction. In order to simplify matters it would be necessary to re-arrange the company's share capital so as to bring it into line with other companies, but in so doing the directors would follow the policy they had previously expressed of giving no advantage to any particular class of share. In any proposal the board might put forward for dealing with the founders' shares they would take into consideration the existing rights of those shares and the dividends they were receiving, and at the same time they must preserve the rights of the ordinary and preference shares. When the scheme had been fully developed the shareholders would be called together to consider the details, but obviously it must take the form of a splitting of the present shares, giving a preferential 6 per cent. share for the nominal capital, and an ordinary share to represent the balance of dividend, such ordinary shares being also given in proper proportion to the holders of founders' shares In conclusion, he said that their rate of progress still continued satisfactory, and he had every hope that the increased dividend would be maintained.

Sir R. E. Martin, Bart., seconded the motion, and the report was adopted.

Rosario Electric Co., Ltd.

At an extraordinary general meeting held at River Plate House, E.C., on Monday, Mr. W. T. Western presiding, a provisional agreement between the company and the Société Financière de Transports et d'Entreprises Industriells was approved, the directors being authorised to carry it into effect.

The Chairman said that the offer for purchasing the undertaking either in its entirety or by selling their shares, had not been sought by the directors, but it came upon them suddenly. Having been interested in the business for some time before the formation of the present company—when it was a small and not very prosperous affair—he should, were he to allow sentiment to influence him, feel very reluctant to part with the undertaking, but the terms offered were of such a nature that sentiment must not be allowed to influence them in their decision. The terms offered were, shortly, the sum of £6 10s. for each £5 first preference share and £9 for each second preference convertible, and for each £5 ordinary share—the partly paid shares receiving the same sum, less the amount of unpaid calls—or, what came to practically the same thing, £518,000 in cash. The purchasers require, in the first place, an option until May 1st, which may be extended until July 1st, to give them time to verify the particulars furnished to them concerning the business and to settle their plans. The transfer is to take effect as on July 1st, and the purchase money is to bear interest from that date, and to be paid not later than December 31st. Inasmuch as the purchasers were working in conjunction with some of the most powerful commercial and financial groups in Berlin, there is no doubt as to their capacity for carrying out the business; they had already, in fact, successfully carried out other large transactions of a similar nature. In addition to the price of £518,000—or £6 10s. and £9 per share—the purchasers offered to pay a further £12,000 for the purpose of compensating the directors. The chairman went on to consider how the proceeds of the sale should be divided.

MARKET QUOTATIONS.

Wednesday, March 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10 10	..
a Copper Sulphate	„	£19	..
a Lead, Nitrate	„	£27	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅝d.	¼d. dec.
c „ Tube (brazed)	„	9¼d.	..
c „ „ (solid drawn)	„	7⅝d.	¼d. dec.
c „ Wire, basis	„	6⅝d.	¼d. dec.
c Copper Tubes (brazed)	„	9¼d.	..
c „ „ (solid drawn	„	9d.	¼d. dec.
g „ Bars (best selected)	per ton	£73	..
g „ Sheet	„	£74	..
g „ Rod	„	£72	£2 dec.
e „ (Electrolytic) Bars	„	£62 10	..
e „ „ Sheets	„	£78 10	..
e „ „ Rod	„	£67	..
e „ „ H.C. Wire	per lb.	8⅛d.	..
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 10/-	inc.
h India-rubber, Para fine	„	8/10½	3½d. inc.
i Iron Pig (Cleveland warrants)	per ton	51/3	1d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 12 6 to £13 15	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 2 6 to £9 5	dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	½d. dec.
p „ „ rolled bars & rods	„	1/3	..
p „ „ rolled strip & sheet	„	1/3	..
o Platinum	per oz.	120/-	variable.
c Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£147 to £148	dec.
n „ Wire, Nos. 1 to 16	per lb.	1/9½	..
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£27 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bron Co., Ltd.
r W. F. Dennis & Co.

Blackpool and Fleetwood Tramroad Co., Ltd.—At the meeting held on February 24th at Manchester, Mr. Geo. Richardson moved the adoption of the report. He proposed that out of the sum of £11,578 standing to the credit of the net revenue account, a dividend be declared for the past half-year at the rate of 9 per cent. per annum, which would absorb £6,750, that £1,750 be written off to depreciation reserve, £500 to general reserve, and the balance of £2,578 be carried forward to the current half-year. In view of the unsettled state of the industries in Lancs. and Yorks., and the bad weather, and considering the results of the various companies who catered for the summer traffic, they had, he thought, done well in being able to pay the usual dividend, and to place to reserve and to carry forward the sums named in the resolution. Mr. R. H. Prestwich seconded, and it was carried unanimously.

Hove Electric Lighting Co., Ltd.—The directors in their report (which we shall print next week) recommend a final dividend on the ordinary shares at the rate of 9 per cent. per annum, making 8½ per cent. for the year, carrying forward £983. The meeting is called for March 10th.

STOCKS AND SHARES.

Tuesday Afternoon.

Rubber is the one thing which occupies by far the largest share of Stock Exchange attention and public interest. The market in the shares has expanded into an enormous—almost an unwieldly—affair, and prices continue to career gaily upwards with only an occasional check upon their wonderful advance.

The continued rise in the price of the product itself has had no effect upon the shares of any of the companies using rubber in their business. Both as regards the telegraph, telephone and electric lighting industries, it is not supposed that the variations in rubber will exert appreciable influence upon profits.

In our price-lists, the most interesting movement is a rise of 6 in Central London Railway Ordinary and Deferred stocks, following upon the heels of improvements in each of the two preceding weeks. The prices have risen to 72 and 52 respectively on steady buying in comparatively small amounts. The Preferred is unchanged.

City and South London eased off ½, but Districts regained their small loss on the opening of the branch line to Uxbridge for traffic. The company's enterprise in initiating a quick get-home-to-luncheon service has been favourably discussed, although it is doubted whether any large number of men will take advantage of the scheme.

Great Northern and City Preferred shares, which have lain dormant for months, changed hands at 15s. 6d. on Monday.

London United Tramways issues are quiet, but Metropolitan Electric Tramways Debenture stock has gained 2, bringing the price up to 95½. The British Columbia Electric Railway issue of Debenture stock prove a signal success, the lists being closed before the appointed time, and this had a cheering effect upon the prices of the existing descriptions. In Anglo-Argentine Trams there is a fair amount doing, though the prices show no quotable changes. British Electric Tractions have not moved. British Westinghouse Preference eased off to 10s. 7½d. Business in the prior-lien Debenture has been marked at par this week.

The Canadian-Mexican division is good, at hardening values. Mexican Light and Power Common rose 3, the Preference stock and the bonds also being better. Mexico Tramways shares and bonds have advanced. Rios rose to 97 for the shares, and 96½ and 89 for the First Mortgage and Mortgage bonds respectively. Canadian General Electric is firm at 120½ for the Common and Preference alike, while Shawinigan Water capital stock hardened to 106½, the company's 5 per cent. bonds being 109, and the 4½ per cent. perpetual Debenture stock 103.

Shares in the two City Electric Lighting Companies, and in the County of London, are in some request, with the result that prices display advances. Edmundson's Preference rose a nominal 5s. to 20s. middle, but London Electric Preference shed 2s. 6d., which is somewhat surprising in view of the generous tribute paid to the company by the chairman of the London, Brighton and South Coast Railway in connection with the work done by the London Company for the railway. The Debenture stock is ½ higher. Westminster Preference and St. James' Preference are both on offer, the former being *ex* the dividend of 3s. 6d.

In the telegraph market has come another sharp turn-round in the price of Anglo-American Telegraph Deferred, which rallied 1—⅛ more than it fell a week ago. West India and Panama shares are harder, and the Eastern group maintains its firm appearance and prices.

American Telephone capital stock continues to go ahead, and New York Telephone Debenture touched 102½ the other day. Anglo-Portuguese Telephone Debenture stock, 2 points lower, is *ex* dividend, and similar markings account for declines in National Telephone Deferred and Preferred stocks.

The oil boom having been started by reports that the Admiralty was going to substitute oil for coal in the Navy—any peg is good enough to hang an early boom upon—Babcock & Wilcox rose ½, because it was supposed the company would receive large contracts for new pattern boilers. Henley's rose substantially, and Ediswan 4 per cent. Debenture stock gained a point to 67½ middle.

County of London Electric Supply Co., Ltd.—The directors recommend a final dividend upon the preference shares of the company at the rate of 6 per cent. per annum for the half-year ended December 31st last, and on the ordinary shares at the rate 6 per cent. per annum for the same half-year, making 5 per cent. the year on the ordinary shares. £16,000 has been placed to re for depreciation and over £3,000 is carried forward.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Feb. 22nd.	Closing Quotations March 1st.	Business done week ended March 1st. 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£8	Nil	Nil	Nil	..	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	Nil.
116 200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	£100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$25,196,600	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	143 —145	144 —146	146½	..	+1	5 9 7
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	3⅞%	3¾%	£3 4s.	3⅜%	58½ — 60½	58½ — 60½	..	..	..	5 19 10
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	99½—100½	99½—100½	100½	99½	..	5 19 1
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	17½ — 18½	18½ — 19½	19	18⅝	+ 1	6 10 7
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101½ —103½	99½ —101½ xd	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	£5	8 %	8 %	8 %	..	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	4 16 8
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86½ — 88½	86½ — 88½	87	..	..	4 10 5
16,000	Cuba Telegraph	£10	5 %	6 %	6 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
6,000	Do. 10 % Pref.	£10	10 %	10 %	10 %	..	16½ — 17½	16½ — 17½	..	..	..	5 12 8
12,981	Direct Spanish Telegraph, Ord.	£5	4 %	4 %	4 %	..	8 — 8½	8 — 8½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref. ..	£5	10 %	10 %	10 %	..	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	£20	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	£20	4½%	4½%	4½%	..	13½ — 14½	13½ — 14½	..	..	..	5 19 1
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	£100	4½%	4½%	4½%	4½%	99½ —101½	99½ —101½	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	135 —138	135 —138	137	135	..	5 1 5
2,000,000	Do. 8½ % Pref. Stock..	£100	8½%	8½%	8½%	8½%	86 — 88	86 — 88	86½	..	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102½—104½	102⅝	..	..	3 16 7
900,000	Eastern Extension, Australasia, and China Tele	£10	7 %	7 %	7 %	..	12½ — 13	12½ — 13	12⅝	12⅜	..	5 7 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
210,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	£5	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 8
181,127	Globe Telegraph and Trust	£10	5⅛%	5⅛%	5⅛%	..	10½ — 11	10½ — 11	10⅝	10½	..	5 4 7
181,127	Do. do. 6 % Pref...	£10	6 %	6 %	6 %	..	13⅜ — 13¾	13⅜ — 13⅝	13⅜	13½	— ⅛	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	£10	20 %	20 %	18 %	..	29½ — 30½	30 — 31	..	..	+ ½	5 16 2
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,300, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..	4 8 8
17,000	Indo-European Telegraph	£5	18 %	18 %	18 %	..	52 — 54	52 — 54	53⅛	52⅜	..	6 18 11
$41,380,400	Mackay Companies Common	$100	3⅛%	4 %	4 %	4½%	92 — 94	92 — 94	..	..	..	4 10 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 82	77 — 82	..	..	..	4 17 7
894,190	Marconi's Wireless Telegraph	£1	Nil	Nil	Nil	..	⅛ — ⅛	⅛ — ⅛	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord. ..	£1	6 %	6 %	6 %	..	⅞ — 1	⅞ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	£1	5 %	5 %	5 %	..	⅜ — ⅝	⅜ — ⅝	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	£100	6 %	6 %	6 %	6 %	107½—109	104½—106 xd	108½	104½	..	5 13 2
3,725,000	Do. do. Def. Stock	£100	5 %	6 %	6 %	6 %	127 —129	123½—125½	127⅝	124	..	4 15 7
15,000	Do. do. 6 % Cum. 1st. Pref.	£10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 10¾	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	£10	5 %	6 %	6 %	6 %	10½ — 11	10 — 10½	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	£5	5 %	5 %	5 %	5 %	5½ — 5⅝	5⅝ — 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	99½	..	..	3 10 0
1,988,593	Do. do. 4 % Deb. Stock Red.	£100	4 %	4 %	4 %	4 %	100 —102	100 —102	101¼	..	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	£1	7 %	8 %	8 %	..	1⅜ — 1½	1⅜ — 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref... ..	£1	6 %	6 %	6 %	..	1 7/16 — 1 9/16	1 7/16 — 1 9/16	..	..	..	4 14 9
195,655	Do. do. do. 4 % Red. Deb. Stock ..	£100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
39,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	£10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	£5	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	£100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	130 —133	130 —133	131½	..	..	4 10 3
120,000	United River Plate Telephone	£5	8 %	8 %	8 %	..	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	7½	..	5 7 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	£5	5 %	5 %	5 %	..	5 1/16 — 5 3/16	5⅛ — 5⅛	98/9	..	+ 7/16	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ — 1½	1⅜ — 1½	..	..	..	3 1o 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	£100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	£10	7 %	7 %	7 %	..	13⅜ — 14½	13⅜ — 14½	14 1/4	14	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	£100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,821	West India and Panama Telegraph	£10	Nil	Nil	Nil	..	3/32 — 3/16	1/8 — 1/4	18/1½	15/7½	+ 3/32	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	£10	6 %	6 %	6 %	..	8½ — 9½	8½ — 9½	8¼	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	£10	Nil	2½	15 %	..	8 — 9	8 — 9	8¼	..	..	6 13 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	£100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	£5	..	..	..	..	4¼— 4⅜	4¼ — 4⅜	98/9	90/7½	..	5 5 5
500,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	£5	..	..	..	..	4¼— 4⅜	4¼— 4⅜	..	..	..	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½— 92	90¼— 92	91⅛	90⅜	..	4 7 0
682,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
380,000	Babcock & Wilcox, 1 to 380,000..	£1	20 %	20 %	20 %	..	4⅛— 4⅜	5 1/16 — 5 3/16	5⅛	5 1/16	..	3 16 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	£1	6 %	6 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	£5	7 %	7 %	Nil	..	¼ — ⅜	¼ — ⅜	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	£5	7 %	7 %	3½%	..	1 — 1⅛	1 — 1⅛	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref. ..	£5	6 %	6 %	6 %	..	2⅛ — 3⅛	2⅛ — 3⅛	..	..	..	..
12,897	Do. do. 4 % Funding Certs. ..	£5	4 %	4 %	2 %	..	¾ — 1⅛	¾ — ⅞	..	..	— ⅛	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98	95 — 98	..	..	..	..
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	139 —143	139 —143	141½	..	..	5 11 11
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	117 —121	118 —122	119½	119½	+1	4 18 4
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —111	110 —112	110¾	..	+1	4 9 3
293,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	£10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	22/6	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	£10	6 %	8 %	1½%	..	2⅜— 3⅛	2⅜— 3⅛	60/-	..	..	4 12 4
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	92	91½	..	5 7 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 73	..	..	..	6 6 8
100,000	British Insulated and Helsby Cables	£5	10 %	10 %	10 %	..	7⅜ — 7⅝	7⅜ — 7⅝	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6⅜ — 6⅝	6⅜	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	105	..	..	4 4 11
304,940‡	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	89 — 94	87 — 92	..	..	—2	4 17 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	£5	Nil	Nil	Nil	..	½ — ⅝	7/16 — ⅝	9/9	..	— 3/32	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	..	..	..	7 16 10
50,000	Brownett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	⅝— 1⅛	⅝— 1⅛	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	39 — 44 xd	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
137,610	Calcutta Trams, 1 to 137,610	£5	8 %	6 %	4½%	..	4⅛— 4⅜	4⅛— 4⅜	86/3	85/-	— ⅛	4 17 9
45,894	Do. 5 % Cum. Pref., Nos. 1 to 39,880..	£5	5 %	5 %	5 %	..	4⅜— 5	4⅜— 5	..	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
85,000	Callender's Cable Construction shares	£5	15 %	15 %	15 %	..	10½ — 11	10½ — 11	10 1/16	..	..	6 0 0
40,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 10 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102⅜—104⅜	102½—104⅜	..	..	..	4 6 2
491,229	Cape E. Trams., 1 to 491,229	£1	Nil	Nil	Nil	..	2 1/16 — 2 3/16	2 1/16 — 2 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	£1	8 %	12 %	12½%	..	2⅜— 2½	2⅜— 2½	..	..	..	5 0 0
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock..	Stock	4 %	3 %	3½%	3 %	65 — 67	71 — 73	73	66⅜	+6	4 2 2
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86⅜	86	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	45 — 47	51 — 53	53	50	+6	3 15 6
1,480,000	City and South London Railway	Stock	3⅛%	3⅛%	1½%	1½%	30¾— 31½	30 — 31	31	30½	— ½	5 12 11
85,000	Crompton & Co., Nos. 1 to 85,000	£	5 %	5 %	Nil	..	⅜— ⅝	⅜— ⅝	12/-	10/-	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otnerwise stated, all shares are fully pa ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations Feb. 22nd.	Closing Quotations March 1st,	Business done week ended March 1st, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	31/32 – 1 3/32	31/32 – 1 3/32	..	..	..	5 19 3
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	1 5/16 – 1 7/16	1 5/16 – 1 7/16	..	..	..	5 9 1
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 –102	99 –102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 – 14	13 – 14	..	..	..	4 7 8
99,361	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,361	3	4½%	2½%	Nil	..	3/32 – 3/32	1/32 – 3/32	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½%	2½%	Nil	..	1 – 1½	1 – 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	64 – 69	66 – 70	..	..	+1	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	81 – 84	81 – 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/4 – 3/8	1/4 – 3/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	..	1 3/8 – 1 1/2	1 3/8 – 1 1/2	..	..	..	10 4 0
95,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 3/4 – 8 1/4	7 3/4 – 8 1/4	..	..	..	6 1 3
210,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	..	83 – 87	83 – 87	..	..	..	4 12 0
75,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 75,000	10	4 %	1½%	Nil	..	3/8 – 7/8	3/8 – 7/8	..	..	..	Nil
95,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ – 10¾	10½ – 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 –103½	102 – 103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	5 %	15%	15 %	15 %	12½ – 13½	13 – 13½	13⅞	13½	+ ⅛	4 6 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5⅛ – 5⅜	5 1/16xd – 5 1/8xd	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ –107½	105½ –107½	..	..	..	4 3 9
60,000	India-Rubber, Gutta-percha & Telegraph Works	10	0 %	10 %	10 %	10 %	15½ – 16	15½ – 16	..	..	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	⅝%	Nil	Nil	1 1/16 – 1 1/8	1 1/16 – 1 1/8	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ – 5	4½ – 5½	..	..	+ ½	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1½ – 2½	1½ – 2½	..	..	..	Nil
899,980	Do. do. 50,008 to 100,000	10	3 %	3 %	Nil	..	1½ – 2½	1½ – 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3½%	..	2½ – 2⅝	2½ – 2⅝	47/6	..	..	13 12 8
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	70 – 73	70 – 73	72	70½	..	5 9 7
6,732,062	Metropolitan Consolidated	100	1 %	½%	½%	1 %	38½ – 39	38½ – 39	39	38½	..	2 12 8
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2¾ %	67 – 69	67 – 69	68½	67½	..	3 19 9
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	17 – 17½	17½ – 17½	17⅝	17½	+ ¼	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	1/8 – 1/4	1/8 – 1/4	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/32 – 1/16	1/32 – 1/16	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	1/4 – 3/8	1/4 – 3/8	..	..	..	5 14 3
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 – 95	95 – 98	97½	94½	+3	4 11 10
$10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	131½–133½	132½–134½	133½	132½	+1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	97½ – 99½	95½ – 96½	99	95½	–2½	5 3 8
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/8 – 3/16	1/8 – 3/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	1/8 – 3/16 xd	1/8 – 3/16	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	84 – 87	84 – 87	..	..	..	5 3 6
87,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	85½ – 87	85½ – 87	..	..	..	5 12 11
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 –102	100 –102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	101½–102½	101½–102½	102 3/16	..	..	4 17 7
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	..	89 – 91	89 – 91	90½	..	..	4 18 4
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 – 34	32 – 34	33	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	1	Nil	10 %	5 %	..	1/4 – 3/8	1/4 – 3/8	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	..	1¾ – 2¼	1¾ – 2¼	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	..	68 – 73	68 – 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4¼ – 4⅜	4¼ – 4⅜	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	..	91 – 94	91 – 94	..	..	..	4 18 9
20,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	..	7⅜ – 8¼	7⅜ – 8¼	..	..	..	6 1 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7¼ – 7⅜	7¼ – 7⅜	..	..	..	4 4 10
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 –102	99 –102	101½	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ – 4⅛	4 – 4⅛	..	..	+ ⅛	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 – 4⅛	4 – 4⅛	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ – 4⅛	3⅞ – 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95¾ – 97½	96⅜ – 98⅛	97⅛	96⅛	+1	4 1 3
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	8¼ – 8⅜	8¼ – 8⅜	70/-	..	..	6 0 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	98 –101	98 –101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	11⅜ – 12½	12 – 12⅛	12 1/16	..	+¼	4 16 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ – 13½	.. ½ – 13½	12½	..	..	4 10 7
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 –125	121 –125	123	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 –102	99 –102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	..	..	1⅝ – 2	1⅝ – 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	2⅜ – 3⅜	2⅜ – 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	91 – 93	91 – 95	..	..	..	5 7 6
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ – 8	7⅛ – 8	7 7/32	..	..	5 6 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ – 11½	10½ – 11½	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 –106	103 –106	104½	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 –102	99 –102	100⅛	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/8 – 3/16	1/8 – 3/16	3/-	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1/8 – 1/4	1/8 – 1/4	..	..	+ ⅛	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	69 – 72	70 – 73	..	..	+1	6 8 3
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	81 – 84	79 – 82 xd	..	..	..	6 1 11
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ – 4⅞	4⅜ – 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4⅛ – 5⅜	4⅛ – 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 – 98	95 – 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	8¼%	8¼%	..	6⅞ – 7⅛	6⅞ – 7⅜	7⅛	6 13/16	+ ⅛	5 15 3
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½–104½	102½–104½	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	..	7¼ – 7¾	7¼ – 7¾	..	..	..	5 3 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ – 96½	94½ – 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅜ – 2⅛	1⅜ – 2⅛	..	..	..	4 4 3
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	5 – 5⅜	4⅝ – 5⅛	..	..	— ⅛	5 14 3
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	91½ – 93½	92 – 94	86/3	85/-	+ ½	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	4¼ – 4⅜	4⅜ – 4⅝	93/9	..	+ ⅛	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ – 5	4⅝ – 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 –107	104 –107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 – 86	83 – 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	83 – 85	83 – 85	84½	84½	..	5 17 8
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	74½ – 76½	77½ – 79½	78¾	76½	+3½	4 8 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	..	103½ –105½	105 –107	107	105	+1½	6 10 10
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	90 – 91	90½ – 91½	91½	90½	+ ⅛	5 9 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 – 98	96 – 98	96⅞	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 187,500	5	3 %	3 %	2½%	..	4 – 4¼	4 – 4¼	..	..	..	2 11 1
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	..	4¼ – 5	4¼ – 5	..	..	..	5 11 1
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 – 101	99 –101	..	..	..	4 19 0
16,862	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12½ – 13½	12¾ – 13½	..	..	..	5 1 10
20,000	Oxford, 1 to 96 and 407 to 20,316	5	7 %	7 %	..	7 %	6½ – 6⅝	6⅝ – 6⅞	..	..	+ ⅛	3 16 9
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	93 – 96	94 – 97	..	..	+1	4 2 6
119,894	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	2½%	6 %	8 %	..	1 1/16 – 1 1/8	1 1/16 – 1 1/8	33/3	..	..	6 1 11
100,000	Do. do. 8% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	..	1 3/16 – 1 1/4	1 3/16 – 1 5/16	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102½–104½	102½–104½	..	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8⅝ – 9⅛	8⅝ – 8⅞xd	8⅞	8 7/8	..	5 12 8
20,000	Do. do. 7 % Pref. 20,021 to 40,020	5	7 %	7 %	7 %	7 %	6½ – 7⅛	6⅝ – 7⅛xd	7⅛	..	..	4 18 3
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	83 – 87	83 – 87	..	..	..	4 0 6
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ – 2⅛	1⅜ – 2⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅜ – 3⅛	2⅜ – 3⅛	..	..	..	9 6 1
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 –103	100 –103	61/3	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	5/16 – 11/32	5/16 – 11/32	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1 5/32 – 1 3/16	1 5/32 – 1 3/16	..	..	..	5 15 6
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	100 –103	100 –103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	3/8 – 7/16	3/8 – 7/16	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1 1/16 – 1 1/8	1 1/16 – 1 1/8	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	74½ – 78½	74½ – 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	1/16 – 1/8	1/16 – 1/8	..	..	..	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅝ – 9⅛	8⅝ – 9 xd	..	..	..	5 11
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4⅜ – 5⅛	4⅜ – 5⅛	..	..	..	4 3

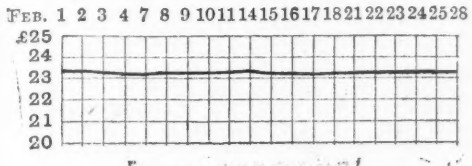
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent., February 10th, 1910.

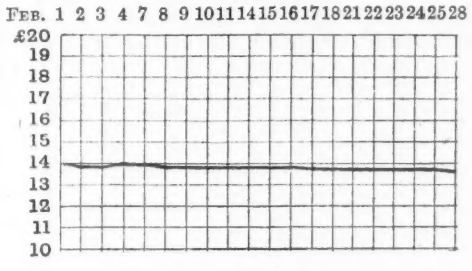
METAL MARKET.

Fluctuations in February.

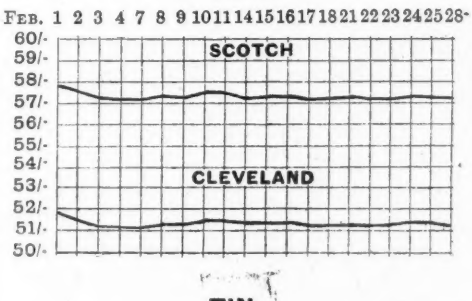
SPELTER (G.O.B's.).



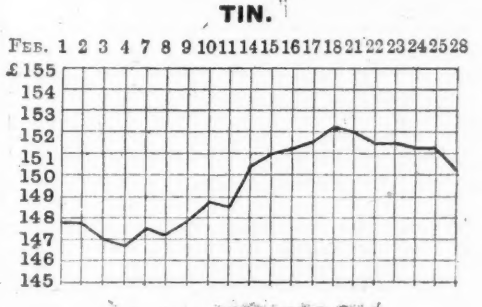
LEAD (ENGLISH).



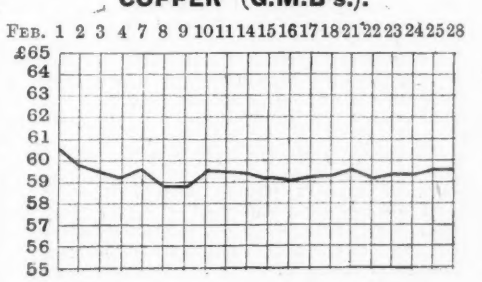
IRON.



TIN.



COPPER (G.M.B's.).



Faraday Scholarship Examination.—An examination for a "Faraday" entrance scholarship, value 50 guineas per annum and tenable for three years, will be held at the Electrical Standardising, Testing and Training Institution, Faraday House, on March 30th and 31st and April 1st. Further particulars may be obtained on application to Mr. H. Foulds, secretary.

SIGNALLING IN MINES.

A remarkably complete and efficient system of signalling has been introduced by the Adnil Electric Co., Ltd., for use in collieries and other mines. In many instances the existing systems are of a primitive character, and are largely dependent upon the human element for their correct transmission and execution; it is, indeed, wonderful how rarely an accident occurs in this connection, in view of the many possibilities of error.

The Adnil system involves the use of a combined transmitter and receiver at each level and at the surface, of which an external view is given in fig. 1; a corresponding instrument consisting of a receiver only is situated in the engine house, where there is also an automatic switch. Each instrument is provided with a loud hooter or bell to call attention to the signals. The signalling is effected as follows:—

If a winding signal has to be given from any level, the miner on that level moves the lever of his instrument a certain number of times until the pointer is over the required signal. For instance, if the signal to be given is No. 6 on the dial, the lever is moved forward six times. This has the effect of also placing the pointers of the other instruments (with the exception of the receiving instrument in the winding-engine house) over signal No. 6. Simultaneously at each point the acoustic signal is sounded a corresponding number of times. When ready for the order to be carried out by the engine-man, the man at the surface passes it on to him by merely pressing once a "carry-out" push (not shown in the figure). This causes the signal No. 6 to be recorded on the dial of the receiver in the engine house, and the electric hooter or bell to sound six times, whilst the pointers on all the other instruments automatically return to the zero point, unaccompanied by any audible signal. The signal thus given remains on the engine-driver's instrument until a fresh signal is transmitted.

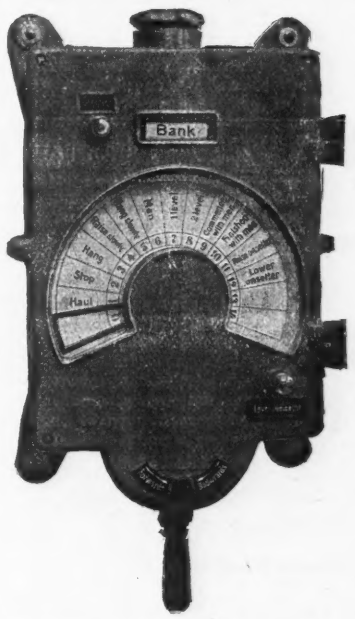


Fig. 1.—Combined Transmitter and Receiver.

Each instrument is provided with an indicator which shows the level from which orders are being transmitted, and by a special contrivance it is rendered impossible for a signal to be given from any other point than that indicated. Should it be necessary, however, for a signal to be transmitted from a different level to that shown by the indicator, this can be done by altering the indicator by means of a special push which is fitted for this purpose. At the same time as the alteration takes place the acoustic signal on each instrument is sounded, thereby drawing the attention of everybody concerned to the alteration. This renders mistakes or malicious interference impossible, and there can never be any doubt as to where each signal is sent from.

In case of pressing danger another signal (differing in tone from the other alarms) can be given by pressing the emergency push. This signal is sounded at the surface and in the engine room.

In each of the instruments at the various points there is a recorder, which will be explained before going into the other details. On referring to the diagram, fig. 2, it will be observed that this recorder is furnished with three electromagnets, M_1, M_2 and M_3, the iron cores of which slide in and out when current is sent through the respective windings. The electromagnets are arranged in a circle round a centre crank, to which the movable cores are coupled. The angular displacement of each electromagnet with respect to the others is 120°.

To turn the centre crank round once in the direction of the hands of a clock, a current impulse would have to be sent through electromagnet M_3, another through M_1, and a third through M_2. The crank is geared by a small pinion to a large cog-wheel B, on whose shaft there is a pointer. It is obvious that by choosing the proper proportion between the two gear wheels, the pointer can be moved

to any desired number on the dial in front of which it is placed. The currents are controlled by the brush L, moving over the commutator segments S_1, S_2, S_3, connected to the corresponding solenoids. By reversing the direction of the motion of the brush L, the battery B can be made to send the successive impulses through the electro-magnets in the reverse order, so that the pointer moves in the opposite direction.

The function of the automatic switch is to store up the signal given at any point, and to pass the signal on to the engine driver when the surface man depresses the "carry-out" push. When the principle on which the storing-up of the signal is based has been grasped, the rest of the system is easy to understand. The principle can be readily explained by means of the simplified diagram, fig. 3. On this diagram the recorders at the bank and down the pit only and the corresponding bells or hooters are shown. At the bank the "carry-out" push only, and in the pit the signalling lever only, are in evidence. The rest of the apparatus has been left out, as it is unnecessary for the purposes of this description.

The apparatus inside the double dotted lines represents the automatic switch.

M is a motor coupled to a shaft S on which are fixed a pinion P and two disks D and D_1. The pinion P drives the signal storing disk S S D. A brush B bears on a piece of insulating material fixed on the edge of the disk S S D. Disk D has also a small segment of insulating material on which a brush bears until the disk is moved

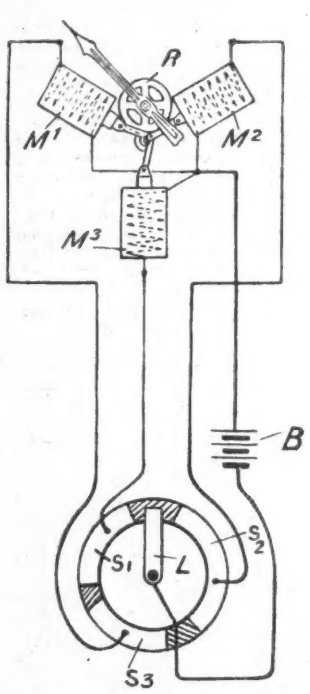


Fig. 2.—Recording Mechanism.

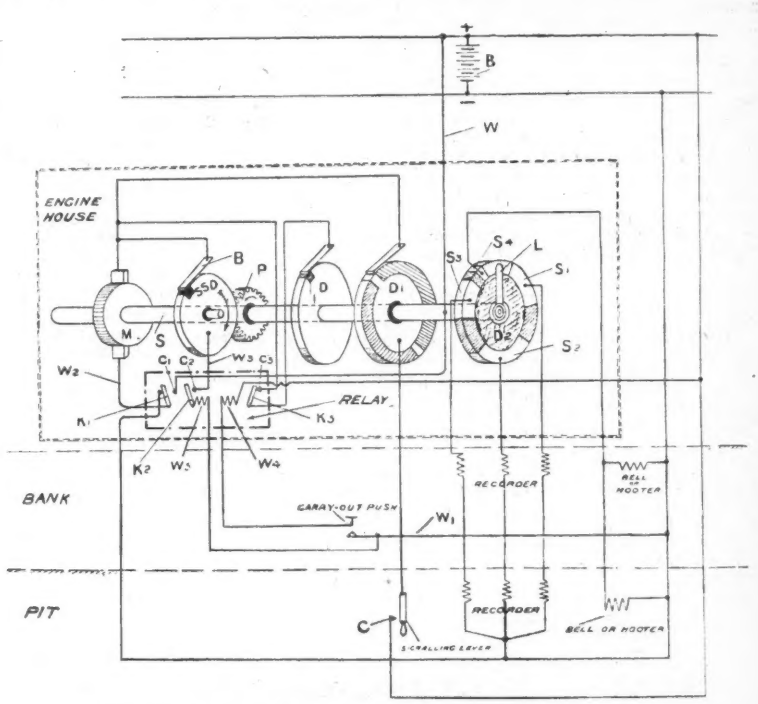


Fig. 3.—Diagram of Connections of Automatic Switch.

and its metallic part brought into contact with the brush. Disk D_1 has a rim of insulating material, except at one point where the brush bears on a segment forming a part of the solid metal. Disk D_2 is stationary, so that when the motor turns the shaft the brush L is brought into contact with the segments S_1, S_2, S_3 and S_4 in succession. The order in which contact is made with these segments is reversed when the motor runs in the reverse direction.

The slightest turn of the pinion P will cause the metallic part of the disk S S D to be brought into contact with the brush B.

We will now suppose that the man in the pit wishes to give a signal corresponding to point 3 on the recorders. To do this he brings his signalling lever into contact with C three times. *Each time the lever is brought into contact with* C the following circuit is closed, and the following functions are performed by the automatic switch:—

The circuit closed may be traced from the + pole of the battery B through signalling lever, disk D_1, motor, armature K_1 of the relay and back to the − pole of the battery. The motor instantly turns the shaft and breaks the contact at disk D_1, but at the same time causes contact to be made at D, so that the current is kept flowing from + pole of the battery through wire W, shaft, disk D, K_3 of relay and through the motor to − pole of the battery. The shaft therefore has to make a full revolution before the contact with the brush on disk D is broken again by the segment I.

This one revolution of the shaft will have caused two distinct functions to be performed:—

1. A current impulse will have been sent through the medium of brush L through each of the three coils of each recorder, and through the bells or hooters. The pointers of the recorders will, therefore, have moved on to the next point on the dial, and the bells or hooters will have sounded once.

2. The pinion P will have turned the disk S S D round a certain distance. (The signal storing disk S S D is so geared as to make only one complete revolution when the shaft S has turned round the maximum number of times.) The slightest turn of the shaft will suffice to bring brush B into contact with the metallic part of disk S S D.

The pinion P having been turned round three steps, through the signalling lever being brought into contact with C three times, the "carry-out" push is now depressed by the bankman. A current will thus flow which may be traced from the — pole of the battery, through W_1, "carry-out" push, and winding W_4 of relay to + pole of battery B. The armature springs K_1, K_2 then come into contact with C_1, C_2, while K_3 leaves C_3, and current commences flowing through winding W_3 to the motor. As the current is now sent through the motor in the opposite direction to that which flowed when the signalling lever was operated, the motor will turn back the shaft S until the insulating segment on S S D comes under brush B again. That is to say, the shaft S is now turned backward exactly the same number of times as it was previously turned forward, and the pointers on the recorders are also moved back to the starting point. When the current ceases flowing through the motor by reason of disk S S D the relay releases, and the springs K_1, K_2 and K_3 go back into their normal positions.

It is obvious that another recorder be fitted in the engine room, which could be made to move forward exactly the same number of steps as the "bank" and "pit" recorders are moved backward.

As it was assumed at the outset that signal No. 3 was to be given, the shaft S was caused to make three complete turns before the "carry-out" push was depressed. When the "carry-out" push was depressed, the shaft S was turned back three complete turns by virtue of the signal-storing disk S S D.

Amongst the advantages claimed for this system of signalling are the simplicity and speed with which the signal is transmitted; the assurance that, by a single pressure of a push, the bankman transmits to the engine driver the signal given from below, and only that signal; the level indicator, which shows the point from which the signal is received, and the central contact apparatus, which prevents the transmitters from getting out of step with the receiver. Further, the more sensitive parts of the apparatus are situated in the engine house, where they can be better cared for than would be the case if they were included in the instruments in the pit.

It may be argued, in comparison with the existing systems (if they can be so called) that this system will be expensive to install; but when the monetary loss incurred through the stoppage of the pit, or the greater loss in the shape of human lives, through a signal wrongly transmitted or interpreted, is weighed against the cost of an efficient signalling system, there can be no doubt as to the advantages of the latter.

Dundee.—The ceremony of opening the new power station took place on Wednesday last week, in the presence of a large company. Prof. Ewing, late of Cambridge University, and now associated with the Education Department of the Navy, in declaring the station open, complimented the city on its successful municipal trading in the supply of light and power. After the ceremony a banquet, presided over by the Lord Provost, was held

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Enquirer, Midlands," writes:—"A supply authority (provisional order) supplies a customer 'X.' 'X' makes a deed of assignment, and his creditors appoint a trustee, who carries on the business of 'X' for a time. (1) Is the supply authority compelled to supply the trustee, even though payment in full is guaranteed from the date of deed of assignment? (2) Or can the supply authority refuse to supply the trustee until payment in full of all arrears is guaranteed? (3) If a deposit of 'X' is held by the supply authority which does not altogether cover arrears, can the supply authority demand a deposit from the trustee?"

*** These queries may be answered by reference to Sec. 39 of the Gas Works Clauses Act, 1871, which is incorporated with the Electric Lighting Acts. It is there provided that: "In case any consumer of gas supplied by the undertakers leaves the premises where such gas has been supplied to him without paying the gas rent or meter rent due from him, the undertakers shall not be entitled to require from the next tenant of such premises the payment of the arrears left unpaid by the former tenant, unless such incoming tenant has undertaken with the former tenant to pay or exonerate him from the payment of such arrears." Under this section it has been decided that a manager and receiver of a business of a limited company appointed in an action by debenture-holders did not stand in the position of incoming tenant, but of caretaker for the limited company, and that therefore the company were entitled to cut off the supply unless the arrears were paid (Paterson *v.* Gas Light and Coke Co. (1896) 2 Ch. 476). In a later case (Husey *v.* Gas Light and Coke Co. (1902) 18 T.L.R. 299) this decision was followed. It is conceived that the same principle will apply to a trustee under a deed of arrangement, although it was held (in *re* Flack, *Ex p.* Berry [1900] 2 Q.B. 32) that a trustee in bankruptcy is a "next tenant" within the meaning of Sec. 48 of the Metropolis Water Act, 1871. The best course for "Enquirer" to adopt will be to refuse a supply and let the trustee take such action as he thinks proper. As to the deposit, it would seem that the trustee may be treated as an ordinary new consumer.

"Anxious" writes:—"A supply authority (provisional order) supplies a customer through a penny-in-slot meter. A shortage is found in the cash box, which the customer refuses to make good. Can the supply authority sue in the courts for the amount of shortage? If so, is it to be treated as a debt?

*** It would seem that this is a matter of contract. *Prima facie* the amount of coin found in the cash box is the amount due for current supplied, unless the company can show that the consumer tampered with the meter. The facts are consistent with a theft having been committed; but unless the company can show that the theft was brought about by negligence on the part of the consumer, they must bear the loss (Edmundson *v.* Longton Corporation, 1902, 19 T.L.R., 15).

ELECTRICAL TRADES BENEVOLENT INSTITUTION DINNER.

The Second Festival Dinner of the Benevolent Institution was held on Wednesday last week at the Hotel Metropole. Dr. G. Kapp occupied the chair, and there were about 75 guests.

After the loyal toasts, the President, proposing "The Prosperity of the Institution," expressed his pleasure in supporting so worthy an object. Sir William Preece was unable, through weak health, to be present, but sent a sympathetic message. He had pleasure in reporting that about £260 had been subscribed that day. Trade had been bad of late, and at such a time generous aid to the Institution was most necessary. Anyone might fall on evil days through no fault of his own, and it was well that he should find friends amongst his professional brethren. The supporters of the Institution had worked exceedingly well, and had increased their funds very rapidly; the annual subscriptions amounted to over £100, and last year the donations, excluding the donation from the Manchester Electrical Exhibition (£365), amounted to £579. They had helped five necessitous cases during the year, the grants made amounting to practically the whole of the interest received on investments (£60). The total assets to date were practically £2,400. The management was wise in not spending the whole of the income, in view of the desire of the Committee to grant pensions in the future, for which purpose it was accumulating funds. The Committee, as a rule, inquired into every case before granting relief, but in cases of urgency the secretary gave immediate relief, a very right procedure. Many of the donors were large firms with benevolent funds of their own, and their generosity in subscribing to both was to be admired. His desire was to convince the electrical trades generally that they did a good work in subscribing to the funds of the Benevolent Institution—an annual subscription was better than a single donation of a much larger amount. Last year Mr. Mordey suggested that the I.E.E. and that Institution should pool their benevolent funds, but he saw no advantage in this, as the expenses could not be reduced thereby (being already zero), and he doubted whether the aggregate receipts would be increased. It would, in his opinion, be better for the two societies to exercise a healthy rivalry in good works.

Sir Irving Courtenay replied, expressing his agreement with the Chairman on the question of pooling funds. The Benevolent Institution covered a wider field than the I.E.E., and it was well that it should continue to work on its present lines. He did not believe that the total amounts contributed to charitable purposes had diminished—rather the contrary; but the number of outlets for charity had so greatly increased that the individual amounts were smaller. They should provide, as far as their funds permitted, for those unfortunates for whom they felt so great sympathy.

Mr. Hugo Hirst also responded, expressing his great pleasure in supporting the President. They were all fighting for a living in the electrical industry, and the battle was keener than in other industries; many of their comrades had fallen by the way, and were in need of an "industrial ambulance corps" to assist them. There was no help to be obtained except from those in the same industry, who must strive to enlist all their friends in the army of helpers—it was wonderful what could be done by large numbers, though the individual subscriptions might be small. In his own firm remarkable results had been secured by a trifling weekly contribution on the part of each employé.

Mr. Justus Eck proposed "The President," pointing out not only that Dr. Kapp was president of the I.E.E., but also that, coming from a great provincial centre, he would be able to be of great service to them. The Committee was a working Committee, and would benefit by the remarks addressed to it. Very serious cases had been brought before the Institution, and he was happy to have been able to help in placing the Institution in a position to give immediate assistance to such cases. Some day they might have electrical almshouses, and they must endeavour to accumulate a fund adequate to that purpose. He expected his hearers to promote the interests of the Institution everywhere. The hardest work for the least reward was that done by the members of the electrical industry, and many of them could not provide for the time when they would be unable to work. The Committee was inaugurating a system of collecting small amounts in the large electrical establishments throughout the country. The funds invested were bringing in a good return, and had been most carefully husbanded. He regretted the absence of Sir William Preece, whose enthusiasm had been of the greatest benefit to the Institution.

Dr. Kapp replied, expressing his thanks for the hearty reception of the toast. He was very pleased to observe the cordial spirit evinced towards the movement throughout the country, especially in the Press, which had supported the Institution splendidly. They looked to the Press to interest the great mass of people for whose support they must appeal.

Mr. Guy Burney pointed out that Mr. Justus Eck, as chairman of the Executive Committee, had done an immense amount of spade work, and with the assistance of Mr. Walter Davenport, the secretary, had been very largely instrumental in bringing the Institution to its present flourishing condition; their healths were toasted with cordiality.

Mr. Eck and Mr. Davenport briefly acknowledged the compliment, remarking that it was a labour of love. Mr. Davenport said that the members of the Committee had been much gratified by the expressions of approval which they had received. The technical Press had from the first given their hearty support to the movement, and deserved their most cordial thanks. He proposed the health of "The Electrical Press," to which Mr. T. E. Gatehouse briefly replied, expressing the pleasure which he and his colleagues felt in doing their utmost for the movement.

An excellent musical and variety entertainment was provided, and the function was successful in all respects.

PROCEEDINGS OF INSTITUTIONS.

Modern Electric Time Service.

By F. Hope-Jones, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, February 17th*, 1910.)

When the author read a paper before this Institution just 10 years ago electric clocks were at a very low ebb in this country; the only survivals were the two forms of synchronisation, the Ritchie sympathetic pendulum, and the Lund minute hand clip, both of them necessarily very limited in their applications.

He introduced the "Synchronome" system, and in five years 300 or 400 installations were erected. In 1905 five systems sprang into active competition, and the business of electric time service, which could hardly be established by one firm alone, however successful, was fairly launched.

Independent self-wound clocks, and synchronising systems, present no new features worthy of description.

The systems of electrical impulse dials which are of commercial importance to-day and which practically arrived in the year 1905, are those of Lowne, Aron, Perret, Magneta and Gent. The systems of Campiche and Palmer should be mentioned, because they were the first to give impulse to the pendulum in one substantial

thrust every half-minute and to rotate a count wheel by the pendulum for that purpose, a method adopted by Lowne, "Synchronome," and Gent, and likely to be generally followed.

The time transmitter of Messrs. R. M. Lowne & Son, of Catford, is shown in fig. 1. The pivoted crutch A (the pins at the bottom of which embrace the pendulum rod) has an extension at the top which carries the escapement rod B. The armature C is held up normally off the poles of the magnet by the flat steel spring E through the

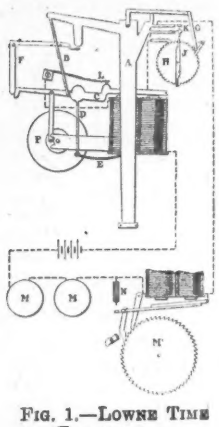


FIG. 1.—LOWNE TIME TRANSMITTER.

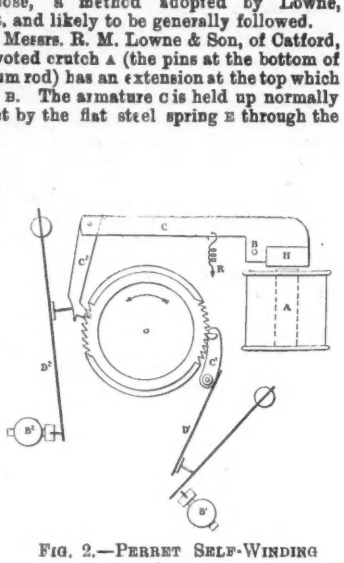


FIG. 2.—PERRET SELF-WINDING ACTION.

medium of the rod D. A pivoted catch lever is seen at F, and a gathering click at G, which revolves wheel H once a minute, bringing one end of the lever J every half minute into the position shown, where it will form an obstruction in the path of the contact springs K mounted on the crutch A and swinging with the pendulum. The contact L being also normally closed, the magnet is energised on each fifteenth excursion to the left of the seconds pendulum, and power is restored in spring E. The series circuit includes the dials M, M, M^1, which are of the simple one-wheel step-by-step type similar to that described in my last paper, but provided with shunt coils N. The armature C, when it is thus pulled down, is caught by F which holds it there until the pendulum on its next swing to the right releases it and allows the spring E to discharge itself into the pendulum through the medium of the escapement rod B.

A fly-wheel P is linked to the armature of the pendulum movement to slow its motion in order to make sure that contact L remains closed until the most sluggish dial has operated. The shunt coils N in the dials, by cutting out the resistance of each magnet as soon as it has operated, increase the current through those that require more.

The system has excellent time-keeping qualities, as the details are of fine design and workmanship.

The Aron system is based upon Dr. Hermann Aron's self-winding action long successfully used in the meters of the Aron Electricity Meter Co., Ltd. It is used to self-wind what may be described as an ordinary striking clock in which the striking part has the sole duty of turning a commutator every minute, sending an impulse to the dials and reversing the polarity of the battery every time. In this respect it follows standard German practice which, in such systems as Grau-Wagner, of Wiesbaden, has entirely justified itself. All attempts to produce systems with uni-directional impulses were abandoned on the Continent long ago, because they could not produce contacts perfectly clean and precise in make and break.

The self-winding action of Perret's system is shown in fig. 2. Magnet A is placed vertically underneath armature H carried on lever C centred at B. The weight of this lever, plus spring R, is driving the wheel through the medium of click C^2. The wheel is usually the centre wheel of a watch escapement revolving once an hour and having 60 teeth. B^1 and B^2 are contact pillars and D^1 D^2 are spring contacts engaging with them and arranged to be opened and closed alternatively by the wheel through the medium of lever C^1 and driving click C^2. The contacts are in series, and as the driving lever C falls, D^2 B^2 is slowly made, D^1 B^1 being then open. C^1 now drops over the top of a tooth and D^1 B^1 is quickly closed, the magnet operated, and D^2 B^2 is quickly broken.

Relays are used for circuits of dials which are of the simple one-wheel step-by-step type.

Contacts operated mechanically by clockwork have the following vices:—What small power is available for making them is robbed from the escapement; they lack precision in the make and break; their duration is arbitrarily adjusted to their supposed requirements; they pass what current is available, regardless of its sufficiency or insufficiency.

In my Institution paper of ten years ago I described a simple mechanism called the "Synchronome" switch, which had ample power, but took none of it from the pendulum or the escapement which drove it; was perfectly clean and precise in the make and break; gave impulses whose duration was largely dependent upon the self-induction of the electromagnets they had to energise; and transmitted sufficient current to operate the dials, or else ceased work altogether.

A gravity lever drove an escapement and pendulum A in the usual way. When it reached contact, an electromagnet replaced the gravity lever on the next tooth of the ratchet.

In 1904, following Campiche, Palmer and Lowne, the escapement was dispensed with and the gravity lever was left normally on a catch, withdrawn every half minute by an otherwise idle count-wheel propelled by the pendulum. In its latest form it is illustrated in fig. 3, in which the gravity lever C normally rests on

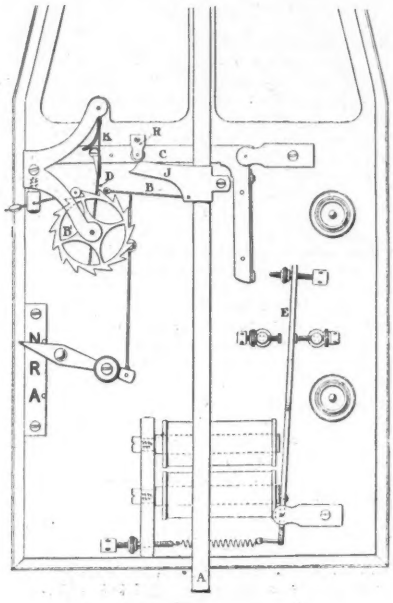


FIG. 3.—SYNCHRONOME SWITCH.

catch K. Once every half minute the lever C is let down (in the act of giving an impulse to the pendulum A) upon the contact screw in the armature E. Current from any available source then passes through the series circuit of dials and the magnet, which attracts the armature E and throws the lever up on to its catch again.

The pendulum releases the switch by means of the 15-toothed wheel B^1, which carries a vane D engaging with the catch K at each revolution. The hook B pivoted upon the pendulum A turns this wheel once every 30 seconds. At the moment of its release the little roller R on the gravity arm C is just above the curved end of the pallet J, down which it runs, giving an impulse to the pendulum at the moment when it passes through its zero or central position. Thus the pendulum is free at all times except in the middle of its swing. The setting lever serves to stop the dials when moved from N (normal) to R (retard), or to accelerate them when moved to A. The method of impelling the pendulum as it passes through its zero position by the falling lever is well known in horology as the invention of Sir H. H. S. Cunynghame, K.C.B., being an adaptation of his detached gravity escapement with free pendulum made as a mechanical clock in 1904.

In addition to the merits of the switch in its old form, its two parts have a longer range of movement and sail into contact at the speed of the moving pendulum; when the current falls below a

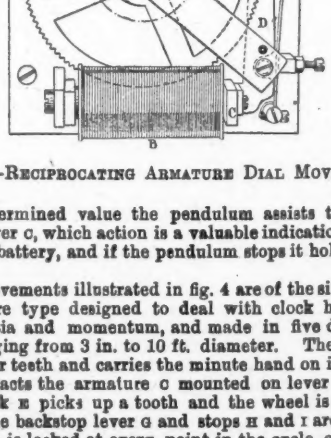


FIG. 4.—RECIPROCATING ARMATURE DIAL MOVEMENT.

certain predetermined value the pendulum assists the magnet to replace the lever C, which action is a valuable indication of impending failure of battery, and if the pendulum stops it holds the switch open.

The dial movements illustrated in fig. 4 are of the simple reciprocating armature type designed to deal with clock hands of considerable inertia and momentum, and made in five different sizes for clocks ranging from 3 in. to 10 ft. diameter. The wheel A has 120 rectangular teeth and carries the minute hand on its axle. The magnet B attracts the armature C mounted on lever D, by which means the click E picks up a tooth and the wheel is propelled by spring F. The backstop lever G and stops H and I are so arranged that the wheel is locked at every point in the cycle of operations, yet can be freed at once by raising the lever G.

The time transmitter of Messrs. Gent & Co., of Leicester, is very similar, and the dial movement of the Gent system is also very similar to that illustrated in fig. 4 in its earlier form; in fact,

most unidirectional current systems have now adopted the electromagnetic time counter described in the 1899 paper.

From the first inception of the "Synchronome" system in 1895, the dominant idea was to design these dial movements for quick action and the switch for slow action, giving the latter both mechanical and electrical inertia. The dials are made to work with less current and with a contact of shorter duration than is required to operate the switch, but it was obviously desirable to measure the extent to which the current rate and the duration of the contact exceeded in ordinary practice that required by the dials; and it is well to demonstrate in a convincing manner how short is the duration of impulse necessary, because nothing less than a whole second was previously used, and most systems of electric clocks on the Continent and in the United States of America still have impulses whose duration is from 50 to 100 times longer than necessary.

Thanks to Mr. Duddell's oscillograph, I have now been able to investigate the precise nature of the impulses transmitted by the "Synchronome" switch, and exactly what happens in circuits of electrical impulse dials of varying number and size. The precision of the make and break has been demonstrated, and it has also been

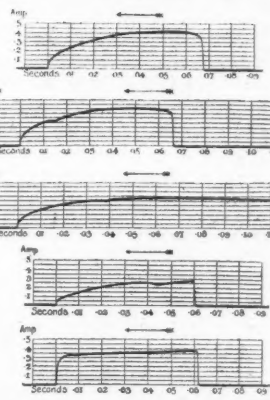


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Current Waves of Synchronome Clock Circuits.

possible to determine precisely the most efficient arrangement of electric time circuits with regard to duration of impulses and voltage, and to lay down rules whereby full advantage is taken of the compensatory effects of increased duration of impulses consequent upon decline of battery.

For the purpose of this investigation a "Synchronome" time transmitter of the type illustrated in fig. 3 was used in series with various sizes and numbers of dial movements as illustrated in fig. 4. An oscillograph was included in the series circuit, and the wave-forms were recorded on partially-counterbalanced falling photographic plates, arranged so that the mean speed of the plates was 100 cm. per second.

The arrows indicate the direction of the fall of the plates past the spot of light from the mirror of the oscillograph.

Fig. 5 is the wave-form of an impulse of the transmitter alone with nothing but the oscillograph in circuit. The E.M.F. (three small dry cells) was 4·2 volts, and total resistance 9·46 ohms. The full value of current, 0·44 ampere, was not reached until 0·05 second. At 0·06 second as the armature approaches the poles of the magnet with considerable velocity the back E.M.F. begins to reduce the current, which drops to 0·35 ampere, when the switch lever is thrown off by its momentum. The precision of the make is worthy of special notice. It is due mainly to the switch arm "sailing" into contact at the speed of the moving pendulum. The break is practically instantaneous; this is the natural result of the armature being stopped dead against the poles of the magnet whilst the lever is free to fly off on to its retaining catch. The area enclosed by the curve is the measure of the current consumed, and = 0·023 coulomb, = 6·7 ampere-hours per annum.

Fig. 6 is the wave-form of an impulse with one small dial movement (as used for a 12-in. clock) in series with the transmitter. One cell was added to keep the current rate nearly the same, the figures being 5·6 volts, 13·62 ohms, and 0·41 ampere. The dial has operated on 0·3 ampere after the circuit has been closed for 0·015 second, a fact that is revealed by the back E.M.F. set up on the completion of its armature stroke. This clearly proves the unnecessarily long duration of the impulse.

The effect of adding this dial without an extra cell is shown in fig. 7, in which the figures are 4·2 volts, 12·62 ohms, and 0·33 ampere. The current did not rise to the 0·3 necessary to work the dial until the switch had been closed for 0·04 second, and the total duration of contact was 0·1175 second. Thus, by fixing the current necessary to work the switch at a higher value than that required to operate the dials, the former cannot work at all without transmitting sufficient energy to operate the latter, the same margin for safety being maintained throughout the fall of voltage, so that, if there is sufficient electrical energy available to work the switch, the dials are bound to work. The area enclosed by curve fig. 7 is 0·036 coulomb = 10·5 ampere-hours per annum, so it is obvious that the higher the voltage the less current will be consumed, because of the difference in the duration of contact.

In these wave forms the self-induction is small relatively to the mechanical inertia of the switch. Self-induction has been considered an enemy in other systems, but we can now welcome all the electromagnetic inertia that our instruments possess. With the electromagnet wound to a higher resistance to increase the self-induction and the armature field limiting screw brought forward to reduce the work to be done, the switch completes its functions, and the circuit is broken again before the current has risen to the full value which it would have attained if time had permitted or the work to be done had required it.

The dials operate at 0·25 ampere, and the effect of the added self-induction is clearly seen in the longer time required for the current to rise to that value. A circuit of 12 small dials takes 0·02 second, 36 take 0·025 second, while 48 dials, including some larger turret clocks, take nearly 0·05 second.

Fig. 8 shows the wave-form in a circuit comprising 12 small movements and two large ones, having a total resistance of 61·8 ohms, with E.M.F. 23 volts, and current 0·37 ampere. The area of the curve is 0·012 coulomb = 3·5 ampere-hours per annum. The dials operate at 0·25 ampere in 0·045 second, and the switch breaks at 0·27 ampere in 0·06 second. The voltage might decline to 16 (a drop of 30 per cent.) or 26 ohms resistance might be included in the circuit (an addition of 42 per cent.) before the magnet would refuse to reset the gravity arm. But the duration of the impulse would be two or three times as long.

This compensation for drop of voltage and rise of internal resistance of battery is more than we need for securing safe going of the dials, but it is most useful as a means of indicating impending failure of battery. The most effective battery warning is the sudden increase in duration to a whole second which occurs when the current is insufficient to operate the switch, though still enough to work the dials. The switch then remains closed until the pendulum on its return swing assists the magnet to replace the gravity arm on to its catch.

That the inertia of the dial armatures cannot be ignored is demonstrated in wave-form, fig. 9, in which the circuit comprises the switch and 12 small dials as in curve fig. 8, but the current is taken from the lighting mains at 204 volts with a 32-c.p. 200-volt carbon-filament lamp in series. The beginning of the curve is steep owing to the voltage being high and the self-induction trivial compared with the non-inductive lamp resistance. Though these dials will work on 0·25 ampere if they have 0·02 of a second to do it in, the current has to rise to above 0·3 to accomplish the work in half the time; any attempt to work them more quickly would involve a much higher voltage, and it would be undesirable on account of the noisy action of the dials that it would cause. On this ground also self-induction is welcomed, and one of the reasons for arranging time-circuits in series is that we may have its sum. It will be noticed that the curve rises in a straight line from 0·35 to 0·4. This is due to the lamp filament warming up and reducing its resistance. If the switch had not then had enough it would rise to 5·8 amperes, and when lighting mains are used the lamp selected should have a filament of such resistance that the dials operate in that rise.

As a general rule in time circuits controlled by a "Synchronome" switch, the switch magnet should be wound with that number of turns which will just fail to enable it to work on the current rate which will work the dials.

The voltage should be well above that required to produce the current rate necessary to operate the switch.

All the variations in the stroke of the armature carried out for the purpose of investigating their effect upon the electrical impulses had no appreciable effect upon the timekeeping of the pendulum.

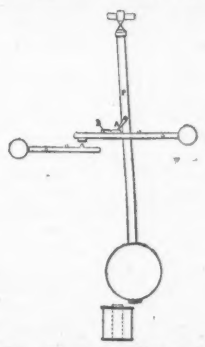


Fig. 10.—Electric Butterfly Escapement.

Fig. 11.—Standard Time Co.'s Synchroniser.

The weight of the gravity arm is 14 grammes, and its normal fall is 4·75 mm. × 120 × 24 × 7 = 1·34064 kilogram-metres = 9·7 ft.-lb per week. This is sufficient to keep a seconds pendulum with 12-lb bob vibrating with an arc of 1½° on each side of zero. We varied the fall of the gravity arm by about 12 per cent., and in doing so we varied the amplitude of the vibrations of the pendulum accordingly, but only within limits in which the effect of the circular error is practically negligible, and the impulse is concentrated as far as possible at zero, whilst at the same time vibration is avoided by curving the impulse pallet instead of making it a straight slope at an angle of 45°. The idea is that the impulse shall begin with extreme gentleness, increase rapidly to a maximum at zero, and diminish in identical ratio.

At 1-volt drop per dial, which is ample for all ordinary sizes for interior use, the consumption of energy should not be more than 3·5 watt-hours per dial per annum, this low figure being due to the small contact time factor of only 10 hours per annum.

Brief mention should be made of two more systems which have appeared since 1905—Bowell's and Murday's. The vibrations o

the pendulums of the master clocks in each of these systems are maintained by the Foucault-Hipp electric "Butterfly" escapement illustrated in fig. 10. The little trailer A pivoted freely on the pendulum P swings clear of the notch in the block B until the arc falls to a certain predetermined minimum, when it jams in the notch and presses the two counterbalanced levers together, making a reliable contact and causing the magnet below the pendulum bob to restore the arc.

In both systems a count-wheel is used to select the semi-vibration at each half-minute when contact shall be made for the operation of the dials.

In G. B. Bowell's system (made by the Silent Electric Clock Co.) the pendulum charges into contact springs at the end of its swing, making a comparatively long contact to operate dial movements with rotary armatures in a permanent magnetic field.

In T. J. Murday's system (made by the Reason Manufacturing Co., Ltd.), the contact is a passing one made at zero, and the dial movements have reciprocating armatures pivoted between the poles.

By the addition of a third contact lever below the other two the Standard Time Co. provide an alternative source of electrical energy which comes into operation if the first one fails. Gents, of Leicester, have recently introduced a simple means of bringing a Hipp-driven clock under the control of a half-minute time circuit, similar in principle to that used by the Standard Time Co. for synchronising it (fig. 11). In vibrating, the pendulum pulls round the wheel E by means of the hook-shaped pawl A. The length of the pendulum or the number of teeth on the wheel E are so arranged that the hands of the clock are advanced half a minute in about 27 seconds by means of this gathering pallet A. A pin F in the wheel E then lifts the control lever C and disconnects the pawl A by lifting it out of the wheel E and allowing the pendulum to oscillate idly. When the half-minute time-circuit impulse energises magnet D_1 the arm C_1 of lever C is released and the pendulum again drives the hands as before.

A constantly running motor controlled by a "chaser" switch may be suitable for the "Big Bens" of the future. A motor with a double-worm reduction gear, reducing the speed from, say, 1,800 R.P.M. to one revolution in $5\frac{1}{2}$ minutes, carries a disk rheostat on its slow-moving axle. A switch arm mounted freely on this axle is driven by an electrical impulse dial movement in a standard time-circuit of half-minute periodicity on to the contact studs, cutting out resistance in the motor or armature field. These resistances are so proportioned that the motor is constantly running at a speed dictated by the half minute progression of the chaser switch.

The experience of the last ten years has shown that the principles then formulated before this Institution are necessary to the success of any system of electrical impulse dials with simple movements for operation by unidirectional currents. The most important of those principles were the transmission of energy through the surfaces of the contact and taking it from the electromagnet instead of from the clock or its pendulum; the immense economy of current and the certainty of its sufficiency obtained by short duration contacts dictated by the self-induction of the whole system; and the momentum stop in the dial movement. Since then the application of Sir Henry Cunynghame's free detached gravity arm and the extended range of battery warning given by the pendulum's assistance to the magnet in re-setting the switch, have given a great impetus to electric time service.

Mr. H. R. Kempe (Electrician to the Post Office), in opening the discussion, said that while the honour of being the pioneer of the electric clock system belonged to Mr. Ritchie, no man living or dead had done more than the author to make it a practical success. One reason why electric clocks had been a failure up to within the last few years was the difficulties experienced in the maintenance of the batteries, and the success which had now been achieved was very largely due to the invention of the Leclanché cell and the dry battery. Mr. Hope-Jones had stated that nothing of importance in synchronisation had been achieved since he first referred to the matter ten years ago, but, as a matter of fact, a very large amount of synchronisation work had been done at the General Post Office in the last year or two. Their chief reason for synchronising up to the present, in preference to adopting electrical clocks, was that they had a very large number of spring-driven clocks in various offices, and it would hardly be economical to scrap the whole lot for the purpose of putting in electrically-driven clocks. The Post Office synchronisation system was extremely simple, cost little to maintain, and worked perfectly satisfactorily. Moreover, in synchronised clocks it was possible to tell exactly what the time was to within a few seconds, but with electrically-driven clocks one had to wait until the impulse came, and then it was uncertain whether that was the commencement or the termination of the half-minute impulse. Keeping the contacts clean had a very important bearing on the success of electric clocks. Non-inductive shunts should be used more frequently, because, if they were applied properly to a magnet, they completely extinguished the sparks, and the contacts ran for a long period without the slightest trace of oxidation. He desired to emphasise the author's remarks with regard to the trouble frequently caused to the system due to the lack of expert handling. It was extremely important that the adjustments should be as few as possible, and many of them should be permanent, so that the mechanic who was sent to make repairs could not put the vital mechanism out of order. Too much had been made by the author of the amount of current used in clocks regardless of the sufficiency or insufficiency. The total amount of current necessary to keep an installation of 100 clocks going did not cost more than half-a-crown per annum, and even if that amount was brought down to 6d., the interest on the capital required to effect the saving might be greater than the amount saved.

Mr. A. C. Brown said his principal object in speaking was to endeavour to induce the makers of electrical time systems not to perpetuate the fearful blunder which had been made by other clock makers, the three-degree arc. It was considered the right thing to keep the pendulum to a very low, and consequently feeble, arc of oscillation, but a clock kept better time when it "kicked out" well—*i.e.*, when its arc of oscillation was much more than the conventional three-degrees. Very much greater accuracy of time keeping would thus be obtained, an important element in which the electrical system stood to gain over the ordinary mechanically wound clocks. The electrical time service also possessed a very great advantage over the mechanical one in that the pendulum could be separated from the clock. Pendulums were greatly influenced by surrounding local gravitational influences, the removal of a couple of tons of coal from a cellar over which a clock was kept having been known to affect the rate of swing of the pendulum. The best place to put a pendulum was down in a basement, as near mother earth as possible.

Mr. E. T. Cook thought too much had been made of the question of keeping the current consumption down. The total amount was so small that one might easily spend 10s. a year in current, and if advantages were thereby gained in the way of a better system it was money well spent. The Murday contact system was capable of being made very clean and precise, and there had been no interruptions for four years on three dials which had been experimented with at the East London College.

Mr. J. N. Alty said that in comparing the several devices described by the author in his present paper, and that read by him 10 years ago, he was struck by the relative simplicity of the recent form of the Synchronome switch. Five years' experience of an installation, comprising several dozen dials, proved that with good wiring and reliable batteries, satisfactory operation could be expected. Certain difficulties in regard to inductive action were, he believed, accountable for many failures in wiring, but they could be partly overcome if the dials were connected in parallel instead of, as was customary, in series. The wiring would have to be doubled, but one dial failing to operate would not then interfere with the others.

Mr. W. Duddell said that the question whether a battery would prove troublesome or not largely depended on how many cells were in series. If a large number of cells in series worked a large number of dials, he thought it would be found that the leakage current came to a much bigger number of ampere-hours per annum than the author said was necessary to work the whole of his time circuit, and the risk involved was very great, but with a small number of dials in series there was not much trouble from that effect. Mr. Kempe had stated that it was less costly to synchronise ordinary clocks than to work electric ones, but it seemed to him (Mr. Duddell) that if the cost of sending a man round to wind up the clocks was capitalised, it would amount to a much larger sum than scrapping the clocks and replacing them with some of the simple dial movements exhibited by the author.

Mr. A. E. Ball gave a short description of the improvements he had introduced in electric clocks during the past 25 years.

Mr. A. E. McCloskey said it was disquieting to hear that the master clock could be so easily upset, and with it all the other clocks on the circuit. Would it not be possible to arrange for a current from Greenwich, or any other Observatory, to control all the clocks, either hastening or retarding the making of the contact?

Mr. F. Hope-Jones, in reply, hoped he had not done any injustice to the excellent work carried out by the Post Office. He agreed with Mr. Kempe's remarks on the subject of non-inductive shunts, and he had invariably used them for absorbing sparks. He used large dry cells, principally because they had a low resistance, long-lasting properties, and did not require any attention. The bogey of battery failure, which the non-technical Press was always hurling at them, was completely disproved by some figures he had obtained for 12 large well-known buildings in London, which showed that the average life of batteries was four years. The great point in connection with electric clocks was to make them "fool-proof." Neglect was one of the worst enemies the electric clock maker had to face, such neglect usually resulting in an installation being left with sufficient battery power to keep it going somehow, but not so low that it stopped the master clock. He would much rather the system stopped than that it should work irregularly. With regard to Mr. Brown's remarks, the circular error should not be neglected.

There were good reasons against putting electric time circuit instruments in parallel. Mr. Duddell's remarks on the leakage loss of a battery illustrated how utterly trivial the consumption of current was compared with other considerations. It was not the case, as Mr. McCloskey supposed, that electrically-driven master clocks were delicate and easily upset.

Some Notes on Overhead Line Construction.

By W. B. Woodhouse, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Leeds, February 23rd*, 1910.)

It is proposed in this paper to deal with the construction of "transmission" lines—high-pressure overhead mains run across country on private property, crossing roads and railways and avoiding buildings, villages and towns as far as possible.

The use of such lines in this country is subject to conditions so onerous as compared to those of other countries that small progress has been made; amendment of the present restrictions is most needed on three main points:—

1. Modification of the veto possessed by local authorities.
2. Compulsory wayleaves.
3. Less stringent Board of Trade regulations.

The veto was granted in the days when long-distance transmission was unknown; it should be reduced to a reasonable one instead of being absolute, and the final decision should be in the power of the Board of Trade. It is of almost equal importance that the decision should be made in a reasonable time.

Compulsory wayleaves for overhead lines are sadly needed. An unreasonable landowner or tenant may prevent the construction of a whole line, or may put the undertakers to very considerable expense to avoid his land. In more favoured countries legal machinery exists for fixing the most reasonable route, deciding on the wayleave payment, and ensuring that the settlement is not unduly delayed.

The present regulations of the Board of Trade require factors of safety to be observed which, as compared to those used by designers in other countries, are very high, and they add considerably to the cost of construction.

In the majority of cases the line will traverse pasture or arable land, intersected by hedges, walls and fences; these boundaries form convenient sites for the poles, as involving the least disturbance to the land tenant, and if wayleave payments are to be kept within reasonable bounds, spans must be varied, angles avoided, and single poles used in preference to A or H poles.

For the conductors only copper and aluminium come into consideration; a satisfactory specification for hard-drawn copper wires has not yet been generally agreed upon.

So far as single wires go we need only consider two ranges of, say, Nos. 18 to 15, and Nos. 7 to 0000 inclusive, and the specification of such wires should indicate (1) the breaking stress; (2) the ratio of the stress at the elastic limit to the breaking stress; (3) the ratio of stress to strain within the elastic limit; (4) the behaviour of the metal under torsion and under repeated bending.

The breaking stress in pounds may be expressed as $F = A - B\delta$, where A and B are constants, and δ is the diameter of the wire.

From tests published by Mr. Bolton (Electrical Review, Vol. 60, p. 131, 1907) A = 79,000, B = 41,800 for wires between No. 7 and No. 0000. These figures are rather high, and it may be taken in round numbers that A = 70,000, B = 40,000 are safe values. The safe stress (Board of Trade Rules) is one-fifth of this, or—

$$F = 14{,}000 - 8{,}000\,\delta.$$

It is of advantage, of course, that this figure should be high, but it is also important that the wire should be fairly elastic, and a very high ultimate strength is not consistent with the latter requirement.

All tests should be made on lengths approaching the span lengths to be used. The writer's method of doing this is sufficiently accurate for practical purposes, and does not require the use of a testing machine (Appendix I).

The ratio of the elastic limit to the ultimate stress is of interest, but with a factor of safety of 5 the designer need not consider it, as in wires such as would be used it is of the order of from 50 to 70 per cent.

TABLE I.—Comparison of Aluminium and Copper Wires.

	Aluminium.	*Copper.*
Weight per cubic inch, lb.	0·0967	0·322
Ultimate stress, lb. per square inch	26,000	62,000
Elastic limit, ratio, per cent.	54	70
Elongation with a stress of one-fifth ultimate, per cent.	1	0·4
Linear expansion for a rise of 53° F., per cent.	0·069	0·05
Relative conductivity	62	100

Torsion and bending tests are valuable as a guide to the behaviour of the wire in use, kinking during erection and afterwards ageing due to constant swaying being the most likely causes of failure.

So long as the present factors of safety are required by the Board of Trade, aluminium is not likely to be extensively used here.

The principal properties of hard-drawn copper and aluminium are compared in Table I for wires of No. 6 gauge.

Stranded aluminium cables are used in preference to solid wires owing to the increased tensile strength, the lessened risk of damage from scratches and kinks, and the greater flexibility. Although stranding gives these advantages, the diameter of the cable for a cross-section is greater than that of a solid wire, and the cable presents a greater surface to the wind.

The ratio of the diameter of an aluminium cable to that of a solid copper wire of equal resistance per unit length is (for sizes of copper wire from No. 8 to 0000) 1·44 : 1.

The maximum tension on a wire supended between rigid supports will occur at minimum temperature and maximum wind pressure. The Board of Trade Rules require that the maximum tensile stress calculated for a temperature of 22° F., and a wind pressure of 30 lb. per square foot, shall not exceed one-fifth of the breaking stress.

The tension due to weight alone is, approximately, $w l^2/8 s$. The tension due to a wind pressure of the above amount is $(l^2/8 s)\,(\delta/8)$. The resultant is, for solid or stranded conductors—

$$T = (l^2/8 s)\sqrt{w^2 + (\delta/8)^2}.$$

It is obvious, as the strength is proportional to δ^2 and the loading to δ, that the smaller wires are proportionately more heavily loaded. The tension which may be applied to a wire in still weather will therefore vary with its diameter, but the variation will be to some extent compensated for by the greater ultimate strength of the smaller wires.

As the wires will not be strung under the conditions of weather stated above, it is necessary to know the corresponding tension and sag during still weather at some higher temperature, and also, a figure of importance, the maximum sag corresponding to summer weather.

The following method of obtaining these figures is a fairly satisfactory one; it is given step by step for clearness, but in actual use may be shortened by combining certain of the calculations.

Determination of Sag at any Temperature, Allowing for Wind Pressure and Elasticity.

Given the following data:—

Span (s), diameter of wire (δ), weight of wire per cubic inch (ρ), elastic strain for a given stress, coefficient of linear expansion per ° F., safe stress of wire (F_m).

1. Calculate the sag corresponding to the maximum allowable stress due to wind pressure and weight—

$$s = (l^2/8\,a\,F_m)\,w\sqrt{1 + (\delta/8\,w)^2}.$$

2. Calculate the component of the maximum stress due to weight only—

$$F_o = (l^2/8\,a\,s)\,w = F_m/\sqrt{1 + (\delta/8\,w)^2}.$$

3. Calculate the length of wire for the given span (l), and the sag above determined—

$$L = l + 8\,s^2/3\,l.$$

4. From (3) calculate various corresponding values of $(L - l)$ and F, taking as one pair of values F_o and $(L - l)$ from equation (3)—

$$F^2 = l^3\,\rho^2/24(L - l).$$

5. Plot the curve connecting $(L - l)$ and F (fig. 1), and mark the point (P) having as abscissa the value of $(L - l)$ corresponding to sag s in equation (3), and as ordinate the value of F_o. Mark also on the same ordinate the value of F_m (Q).

6. From the known properties of the wire calculate the elastic contraction due to a reduction of stress from F_m to F_o, and set off P N, negatively, equal to this. Join Q N cutting the curve at R. The ordinate to R will equal the stress on the wire at minimum temperature with the wind load removed, and the corresponding sag may be calculated:—

7. From N set off, positively, N M equal to the elongation due to a rise of temperature from 22° to 75° F. Draw M V parallel to Q N cutting the curve at V. The ordinate to V equals the stress at summer

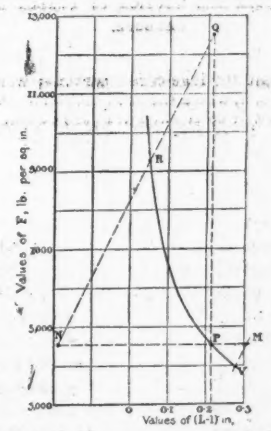


Fig. 1.

temperature in still weather, and the maximum sag may be calculated therefrom. To find the stress at any other temperature N M is reduced proportionately.

The stress for any other span with a wire of the same size may be deduced from the curve by proportion; *e g*, if the span be changed from l_1 to l_2, the value of $(L - l)$ for the same stress is increased as $(l_2/l_1)^3$, the elastic strain is also increased as l_2/l_1, and the temperature strain in the same ratio.

The effect of using a wire of a different degree of elasticity may be studied by means of the curve.

As an example, calculations have been made for a No. 6 copper wire and a span length of 1,000 in. F_m = 12,500 lb. per sq. in. F_o = 4,520 lb. per sq. in. The sag corresponding to F_o = 8·91 in. The value of $(L - l)$ for this sag = 0·211 in. and L = 1,000·211.

A wire of this length loaded only by its own weight will have a tension of 4,520 lb. per sq. in., and a sag of 8·91 in.; for other values of L the tension will vary accordingly, and the curve in fig. 1 is plotted therefrom.

Mark at P, F_o = 4,520; at Q, F_m = 12,500. The change of stress $F_o - F_o$ = 8,000 approximately, and the elastic strain being given as 0·05 per cent., for a stress of 10,000 lb. the actual elongation due to this change of stress is 0·4 in.

Set off P N = 0·4. Join Q N, the intersection gives B, whose ordinate is the value of the winter stress in still weather (= 9,300 lb. per square inch). Set off N M equal to the elongation due to temperature rise = 1/2,000 for 53° F. Draw M V. The ordinate to V is the summer stress in still weather (= 3,950), and the corresponding sag is 10·2 in.

In the same way the sag may be determined for other spans, *e g*, for a span of 2,000 in., the values are—

	F.	Sag.
Conditions of maximum stress ...	12,500	35·6
Conditions of minimum stress ...	4,300	37·4

The further work of design may be much simplified by constructing a set of curves embodying the above calculations, and certain calculations as to the strength of supports, which are dealt with below.

(To be concluded.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Multax Long-Burning Flame Lamps.

An interesting flame arc lamp has been introduced by the Globe Electric Co., Ltd., of 11, Farringdon Avenue, E.C., entitled the "Multax" lamp. The principal feature of this lamp is the use of

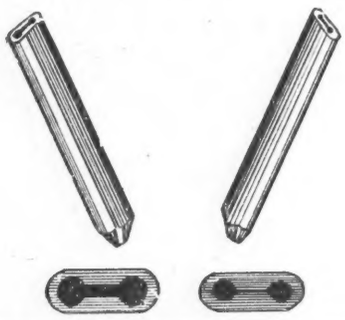


Fig. 1.—Elevation and Section of Patent Bridge-Core Carbons.

the company's patent "bridge-core" carbons; what these are will be gathered from fig. 1, which shows in elevation and section a pair of the carbons. It will be noticed that the outline is an elongated oval, corresponding in fact to two ordinary flame carbons joined

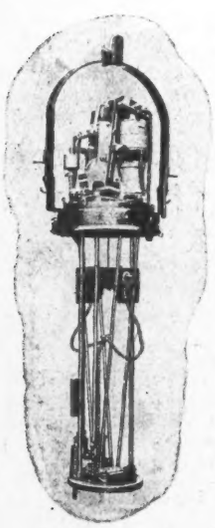


Fig. 2.—Interior of Multax Lamps.

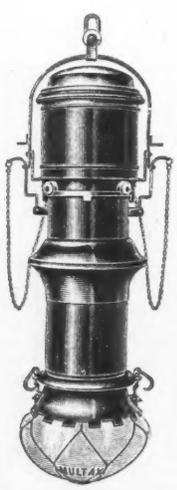


Fig. 3.—Exterior of Lamp, with Substitutional Resistance in Cap.

together by a bridge, so as to give twice the burning hours of an ordinary lamp, without increasing the length of the lamp, or using multiple carbons as in magazine lamps. The carbons are exceptionally strong, and flickering is prevented by the bridge connecting the two cores; the arc passes gradually from one to the other, to and fro, without noticeable variation in the colour or intensity of the light emitted. The lamp is at present supplied for 20 hours' burning with 16-in. carbons, which compares very favourably with the period previously obtained with long and slender single carbons, 28 in. long, while the handier size and greater strength of the patent carbons reduce breakages to the minimum. The mechanism of the lamp is to all intents and purposes identical with that of the standard pattern of Globe-Santoni flame lamp; the working parts are completely enclosed, and thus are protected from the deleterious fumes evolved from the loaded carbons. The 20-hour lamp is only 33 in. long overall, and is suitable for all ordinary purposes; where a longer duration of burning is required, the 36-hour pattern is supplied, which is 6 in. longer. Figs. 2 and 3 show the interior and exterior of the lamp.

We recently inspected a batch of 37 of these lamps, burning nine in series on 400 volts D.C., which has been supplied to the order of the Bengal-Nagpur Railway Co., Ltd.; the lamps behaved admirably, burning with great steadiness, and it was very interesting to observe the transfer of the arc from one core to the other. We are informed that, as the result of the inspection and tests carried out on these lamps, a repeat order has since been placed with the Globe Electric Co. for a further batch of 28 lamps.

Full particulars of the new lamps are given in a new price list, K 14, which has just been issued.

"Twin-Grip" Pendant Lampholder.

A novel device, invented by Mr. H. E. Evans, for the purpose of overcoming the admitted deficiencies of holders with the ordinary type of cord-grip, has been brought out by Messrs. Bell Bros. & Co. (London), Ltd., of 63, Bishopsgate Street Within, E.C. The main feature of the holder is shown by the figure; each of the flexible leads is brought out through a separate nipple and cord-grip, so that short-circuits at that weak place just above the cord-grip are impossible. Another advantage secured by this design is the facility it affords for using C.M.A. flexible, which cannot be comfortably accommodated in the ordinary type of holder; again, the complete failure from any cause of one of the leads would not necessarily involve the other, so that in the case of a heavy fitting carried on one of these holders, in such an event the light would merely go out and the fitting would not fall. We understand that the electrical inspectors of some of the leading fire insurance offices, and others interested in safety from fire risk, have cordially welcomed the new device as a decided improvement upon existing patterns.

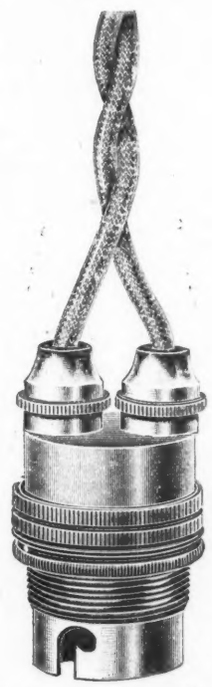


Fig. 4.—Evans Twin-Grip Lampholder.

"P" Type Motors (Mather & Platt).

We have received particulars from Messrs. Mather & Platt, Ltd., of Salford Ironworks, Manchester, regarding a new type of interpole motor which they have recently put on the market.

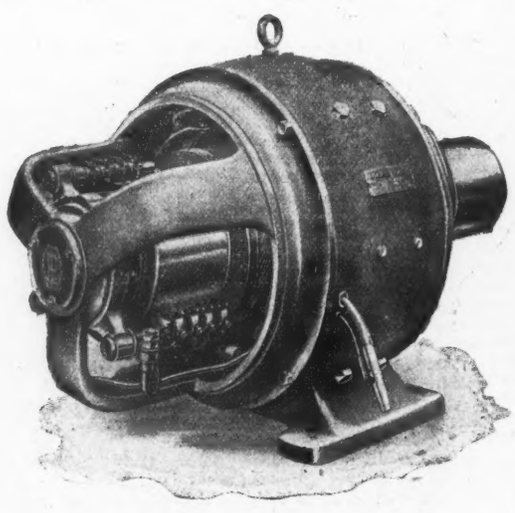


Fig. 5.—M. and P. "P" Type Motor.

The advantages of the interpole construction are well known in cases of irregular and excessive loads; the new "P" type motors

are designed for fixed-brush position and sparkless running up to 100 per cent. overload.

The motors are built up with steel carcases, laminated poles, and grease-lubricated ball bearings at the commutator end of the shafts. Ventilation has been particularly studied, and the temperature rise is limited to 75° F. after 6 hours' run at full load.

The motors are of the open protected type, built in 9 sizes for 110, 220, 440 and 500 volts, and embracing capacities of from 1½ to 60 H.P.; they are all subjected to 3 hours' full load and half-hour's 50 per cent. overload tests.

Cleat Ceiling-Rose.

The accompanying figure shows an ingenious combined cleat and ceiling-rose for surface wiring, introduced by Messrs. Luxley and Co., Ltd., Basinghall Street, Leeds. The device consists of a sub-base grooved to receive the leads, a base provided with brass

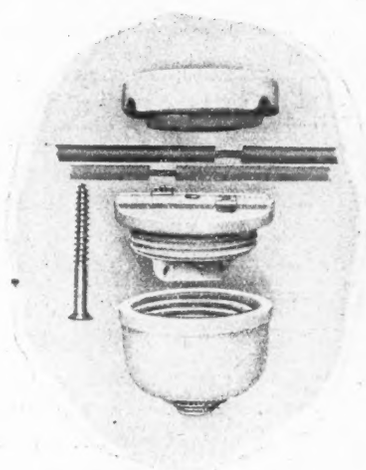


Fig. 6.—Combined Cleat and Ceiling Rose for Surface Wiring.

clamps to make the joints with the bared portions of the leads, and a cover of the usual form, all of porcelain. The base and sub-base are fixed by a single screw through the centre, and the metal parts are reduced to the minimum, the whole forming an exceedingly compact and simple fitting.

Simplex Shaded Fittings.

Considerable attention has been paid by Simplex Conduits Ltd., to the development of their artistic electric light fittings department, which is under the managership of Mr. N. E. Beves, late of the British Prometheus Co. A showroom of representative fittings has been established at Charing Cross Road, in addition to centres in most of the large provincial towns where the company

Fig. 7.—Rosarian Shade and Simplex Rose Bowl Lamp.

already have branches. A comprehensive list has been issued in connection with this department, copies of which can be obtained by forwarding a trade card.

Some 12 months ago the company introduced their quaint Spookie shades. These shades are made of linen and parchment in a variety of designs and colours so as to give an effect, when the light is on, of stained glass. We understand that several new designs are to be put on the market for the forthcoming season, in addition to some improvements in the method of manufacture, which will give them additional effectiveness as an item of decoration.

These shades have "caught on" well, the demand for one type alone, viz., the Night Watch Lantern, which is an imitation of an antique Watchman's Lantern, having run into many thousands. We illustrate the combination of Rosarian shade and Simplex Rose Bowl Standard lamp.

The Phœnix "Cine-Converter."

To meet the demand for a suitable machine for operating the powerful arc lamps used in cinematograph work, the Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, has introduced a specially compact little rotary converter for this purpose.

It is claimed for the "cine-converter" that it runs sparklessly under the heaviest load fluctuations; has a simple brushgear designed to avoid flashing over; is fitted with ball bearings requiring the minimum of attention; and has a high efficiency.

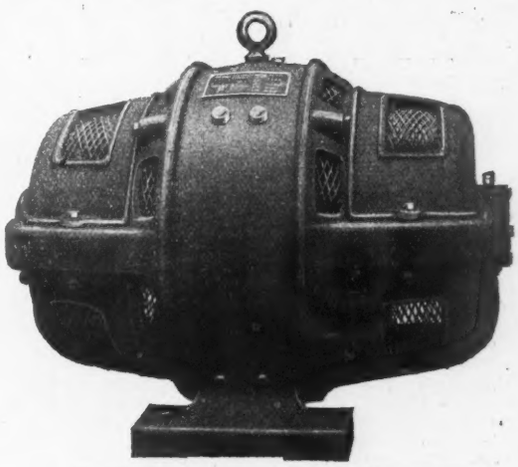


Fig. 8.—Phœnix Cinematograph Converter.

The machine, which is shown in fig. 8, is constructed in three sizes, viz., C.B. 7, 3½ kw.; C.L. 5, 5 kw.; and C.L. 7, 9½ kw.; and supplies current at 60 to 70 volts, running on the 440-volt (or if required, the 220-volt) mains. The overall lengths and weights of the three sizes are:—3½ kw., 1 ft. 11⅜ in., 528 lb.; 5 kw., 2 ft. 4½ in., 712 lb.; 9½ kw., 2 ft. 7 in., 942 lb.

The largest size machine is capable of running the stage side arcs at the same time as the cinematograph arc, thus further decreasing the expenditure on energy.

The Economic Electric Oven.

We recently described the simple electric cooker introduced by Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden,

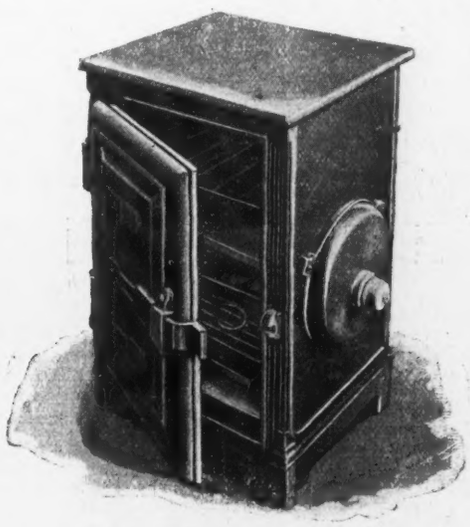


Fig. 9.—Economic Electric Oven.

Herts. (Elec. Rev., Vol. 65, p. 894); this has now been improved, and has also been adapted for use in conjunction with an oven, as shown in the accompanying illustration (fig. 9). The oven itself is of simple construction, being made of cast-iron, with sheet metal linings, the intervening spaces being filled with lagging. At each side of the oven is fitted a heating element, consisting of a grooved plate and coil (similar to that employed in the Economic stoves) contained in a cast-iron cap, suitably

protected with an expanded metal top. The elements and cast-iron caps are quickly removable; connection is made to ceiling roses fitted to the cast-iron caps. The oven illustrated is capable of cooking three or four courses simultaneously, and is large enough for a family of four, the internal dimensions being 19 in. wide × 13½ in. back to front × 20 in. high. In consequence of the arrangement of the heating elements, the ovens can be used for grilling and toasting purposes, the food being suspended in front of the elements; thus two grills can be carried on simultaneously. The ovens are solidly constructed and well adapted for the hard wear and tear of every-day kitchen service. An interesting experiment has been carried out with this oven, in consequence of some inquiries that we put to the makers regarding the power required to maintain the temperature after the proper value had been attained. In addition to external radiation, a continual flow

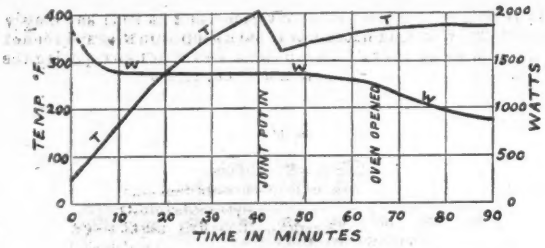


Fig. 10.—Input and Temperature Curves.

of heat into the food being cooked must be provided for. The course of the operation is shown by the curves. The greatly reduced rate of rise of temperature after a 4½-lb. joint was put in, while the input in watts was practically unaltered, is noticeable, as well as the gradual saturation of the joint with heat, so to speak, resulting in the maintenance of the oven temperature with a considerably reduced consumption of power.

Making a few rough calculations from the data available, we find from the initial heating-up curve that about 800 watts would be required to maintain the temperature constant at 350-400° F. The flow of heat into the cold joint is at first about 250 watts, but of course falls off, and the tendency of the watt curve towards a final value of 800 watts while the temperature is kept steady, and the cooking operation approaches completion, confirms our independent calculation from the heating curve. There is much to be learnt from data such as these, and we have no doubt that a thorough scientific investigation of the subject would be well repaid.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

CANADA.—The Canadian Customs authorities have issued a new regulation governing the forms of certificates of origin required for British goods in order to obtain entry under the preferential tariff. The new regulation, which alters the form of the certificate, also prescribes that the country of origin in respect of each imported article must be specified on the margin opposite to such article, or elsewhere on the invoice, when the articles are for entry under the British Preferential Tariff. Moreover, the necessity for stating that imported goods are not of German origin is done away with. The new regulation can be seen, and copies obtained from, the Board of Trade Commercial Intelligence Department, Basinghall Street, E.C.

BRITISH EAST AFRICA.—A new Customs Tariff Ordinance was assented to on January 10th, 1910. By this ordinance a number of additions are made to the list of goods allowed to be admitted free of duty. Industrial machinery and apparatus and appliances for generating and storing electricity are added to the free list, but this addition does not include electric cable or wire or posts for carrying the same, lamp-posts, lamps or their fittings, which continue to pay a duty of 10 per cent. *ad valorem*. The exemption from duty referred to has effect from June 1st, 1906, and refunds of duty paid since that date will be allowed if application is made within six months of the date of the publication of the ordinance (*i.e.*, six months from January 15th, 1910). Other articles on the free list are materials for the construction of railways, tramways and roads, and bands and belting for driving machinery. The following new regulation regarding the basis on which *ad valorem* duty is calculated is also issued:—

The value of goods upon which duty is leviable *ad valorem* shall, for the purposes of this ordinance, be deemed to be the cash price for which the goods are capable of being sold in the Customs House without profit or loss to the importer or exporter at the time and place of importation or exportation, as the case may be, without any abatement or deduction whatever, except (in the case of goods imported) of the amount of duties payable on the importation thereof. The Chief of Customs may, with the approval of the Governor, fix a scale or scales of percentages to be added to the first cost of goods to be valued to cover any charges which should be taken into consideration in estimating the cost at which such goods can be delivered at the place of importation and which are difficult to ascertain.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 235, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,527. "Improvements in and connected with electric burglar alarms." G. A. Aldrich. February 14th.

3,567. "Telephone receiver rest." V. M. Snagge. February 14th.

3,582. "Improvements in and relating to call boxes for telephones and the like." P. W. Wall. February 14th.

3,610. "Improvements relating to the manufacture of tungsten filaments for incandescent electric lamps." Westinghouse Metallfaden Gluehlampenfabrik G.m.b.H. (Date applied for under Sec. 91 of the Act, February 15th, 1909, being date of application in Austria.) February 14th. (Complete.)

3,631. "Improvements in or relating to the manufacture of accumulators and more particularly to the manufacture of positive electrodes for the same." February 14th. (Complete.)

3,637. "Electric cab-controlling system for railways." H. D. Patterson. February 14th. (Complete.)

3,651. "Improvements connected with electric contacts for electric incandescent lamps and the like." H. R. Rushton. February 15th.

3,697. "Improvements relating to the method and means for electrically-controlling valves." F. Lug. (Date applied for under Sec. 91 of the Act, February 15th, 1909, being date of application in Germany.) February 15th. (Complete.)

3,706. "Improvements in packing incandescent electric lamps and similar fragile articles." B. W. Comings. February 15th.

3,729. "Improved shade carrier ring for electric lamp holders and the like." C. E. Gunner. February 15th.

3,756. "Improved contrivance for facilitating the recording of telephone calls." F. Chisholm-Ellams. February 15th.

3,770. "Mechanical block system for tramways." D. Samaia. February 15th. (Complete.)

3,802. "Improvements in magneto dynamo armatures." R. H. Cunningham. February 15th.

3,818. "Improvements in or relating to electric cables." Siemens Bros. and Co., Ltd., and W. Dieselhorst. February 16th. (Complete.)

3,825. "Improvements in electrical apparatus for perforating designs." B. H. Wallin. February 16th. (Complete.)

3,833. "Improvements relating to material suitable for insulation and other purposes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 16th. (Complete.)

3,847. "Improvements in controlling devices for electrically operated machines." C. Henkel. February 16th. (Complete.)

3,857. "Improvements in electric flame arc lamps." H. Peace. February 17th.

3,871. "Improved device for testing the ignition in internal combustion engines." H. W. Southall. February 17th.

3,883. "Improvements in fusible cut-outs for controlling electric circuits." V. Hope. February 17th.

3,900. "Improvements relating to boxes for containing incandescent gas mantles, incandescent electric lamps and other fragile articles." A. H. Stevenson. February 17th.

3,902. "Improvement in and connected with electric automatic tablet or staff instruments." J. Sayers and G. Salt. February 17th. (Complete.)

3,914. "Improvements in arrangements for regulating the position of the brushes on the commutator of a dynamo electric machine." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) February 17th. (Complete.)

3,918. "Improvements in automatic devices for preventing the railway trains from passing stop signals and switches in wrong position." K. Hintz and A. Schmidt. February 17th. (Complete.)

3,926. "Improvements connected with switches or other accessories used on electric lighting, heating or power circuits." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. February 17th. (Complete.)

3,927. "Improvements in electric switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. February 17th. (Complete.)

3,954. "Electric safety switch." H. Ramsbottom. February 17th.

3,958. "Improvements in liquid compasses for use in connection with ships' course recorders and the like." A. K. W. Rissell. February 17th.

3,977. "Improvements in or relating to portable holders for electric incandescent lamps." S. G. S. Dicker. (Benjamin Electric Manufacturing Co., United States.) February 17th. (Complete.)

3,981. "Improvements relating to the treatment of metals of the chromium group." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 17th. (Complete.)

3,892. "Improvements in signal systems for railways and the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 17th.

4,018. "Improvements in and relating to stepped ladders for electric lamp posts, signal posts, fire escapes and the like." J. Weir and J. Reid. February 18th.

4,066. "System of isolating and feeding electric cables and fittings for portable or fixed electric lamps or other fittings in coal bunkers, mines, magazines, spirit, petrol and other similar stores and places such as showrooms where highly inflammable materials are kept." E. E. Rogers. February 18th.

4,115. "Improvements in apparatus for distributing electricity." E. W. L. W. Walmsley and J. T. Walmsley. February 19th.

4,127. "Improvements in means for indicating and measuring leakage from electric circuits." F. O. Hunt. February 19th.

4,171. "Improvements in or relating to electromagnetic brakes." Westinghouse Electric Co., Ltd. (Date applied for under Sec. 91 of the Act, March 3rd, 1909, being date of application in Germany.) February 19th. (Complete.)

4,182. "Improved electric resistance." F. A. Glover and F. A. Glover and Co., Ltd. February 19th.

4,183. "Improved electrical contact." Particulars same as 4,182.

4,184. "Improved ceiling rose for electric light." Particulars same as 4,182.

4,185. "Improved circular riding machine." Particulars same as 4,182.

4,186. "Improved cord shortener for electric circuits." Particulars same as 4,182.

4,190. "Improvements in or relating to electrical controllers." H. P. Gibbs and Sandycroft Foundry Co., Ltd. February 19th.

Salford Tramway Employés.—The employés in the Salford Corporation tramways department have just formed an angling club, of which Alderman Linsley has been appointed president. The employés have already social, athletic, football, cricket and swimming clubs, as well as a band of their own.